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Task IQM15 - Area/Environment Essential Model

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13. ABSTRACT *(Maximum 200 words)*

Information Object Modeling is a technique for developing specification models for systems. The techniques for building Information Object Models were adapted from techniques of real-time structured analysis and the Foxboro company's experience in specifying and developing real-time process control systems.

An Information Object Model (IOM) is organized to provide levels of information for different audiences, so that one document can meet the needs of different people. A mission statement is provided which describes the scope of the system. An overview of the system describes the major functional objects. Finally, each functional object is discussed in detail.

The modeling techniques for an IOM use the graphical techniques real-time structured analysis, including transformation diagrams (data flow plus control flow), state transition diagrams, and entity relationship diagrams. Transformation diagrams, however, are applied in a different manner, representing the communication of objects organized hierarchically rather than a functional decomposition of processes.

This document describes a specification model for an air traffic control system prepared using Real Time Structured Analysis. It shows Foxboro's concept of specification packaging and can serve as an alternative to MIL-STD-2167A.

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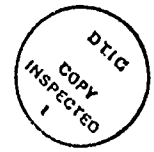


Preface

The *STARS Structured Specification for the DoD Advanced Automation System* which shall also be referred to as the *DoD Advanced Automation System Information Object Model* is the Required IBM Deliverable for STARS Task IQM15, Phase II. This document serves as an example of:

- IOM Packaging Concepts,
- Application of the IOM layered modeling techniques and
- IOM Object decomposition, learned, practiced and refined during IQM15 phases I and II.

This document is not intended to be a tutorial on the IOM Methodology; it is an example of its application. A paper will be be prepared for STARS Task IQM15 Phase III which will discuss the IOM methodology and serve as a companion document to understand the techniques employed in the preparation of this deliverable.

This document should not be viewed as an official document in its descriptions of a proposed *DoD Advanced Automation System.* Although our original intent for IQM15 phase II was to faithfully apply the methodology as learned during IQM15 phase I and concentrate on extensive information capture, this was not possible. The IOM methodology, as practiced by Foxboro, was not completely conveyed during IQM15 phase I and there was no reference material available which explained IOM modeling function (how to apply the methodology) and IOM modeling form (what things should look like after the methodology has been applied). IQM15 phase II became a discovery process, where we modeled several versions of a DoD AAS in our process of learning Foxboro's techniques, as well as refining them. This document represents work performed over a forty-five (45) day period during QM15 phase II, where the IBM team applied the methodology, from insights gained through interactions with Foxboro personnel. Further, several of the QM15 team members spent time in the months of January and February, 1990 to populate their sections of Excelerator database and document their IOM models.

In the IOM development process, several versions are prepared during the 90 to 120 day analysis period. The first version of the IOM is referred to as the "first pass book." This version is to be reviewed and critiqued by domain experts who generate issues and problems that need to be addressed in the "second pass book." Typically only two books are required, but a third can be produced, if the IOM is not sufficiently complete. This product represents a "first pass book." The "first pass book" may or may not be complete, but has sufficient material in it to conduct a technical review for material validation with domain experts.

Although this IOM is not complete, it does serve as a good example of the form of an IOM. The most illustrative example of the IOM layered modeling technique (also referred to as the *White Layered Model*) is the Information Object Model for *1.0 Traffic Surveillance.* The most complete example Information Object Models in the document are *6.0 Flight Plan Entry Support* and *7.0 Flight Plan Operation Support.*

Abstract

The *DoD Advanced Automation System Information Object Model* is a deliverable from IBM STARS Task IQM15, Phase II. This document serves as an example of 1) IOM Packaging Concepts, 2) Application of the IOM layered modeling techniques and 3) IOM Object decomposition, learned, practiced and refined during IQM15 phases I and II. This document is not intended to be a tutorial on the IOM Methodology; it is an example of its application. A paper will be be prepared for STARS Task IQM15 Phase III which will discuss the IOM methodology and serve as a companion document to understand the techniques employed in the preparation of this deliverable.

An Information Object Model is a specification for a proposed system, that 1) describes the context for a system, 2) describes the major functional objects of that system and how they relate to each other by the information they share and 3) provides a description of the major functional objects of the system, using extensions to real-time structured analysis, referred to as the Foxboro Methodology in this document. Preparing an IOM for a project involves the interviewing of domain experts, as well as documentation review. Information from interviews are recorded in a CASE tool for diagram generation. The diagrams generated from the CASE tool are used as a communication vehicle to validate and refine the model data stored in the CASE tool database.

STARS was interested in the Information Object Model specification process as a means for developing a complex specification in a short time period of 90 to 120 days. The 90 to 120 day period of performance assumes that the team to build the IOM is fully trained in the methodology and associated tools before the beginning of the modeling effort. One of the goals of QM15 was to explore the use of the IOM product as a means to initiate a concurrent software development life cycle. Another goal was to examine the potential role of the IOM in the procurement process. An IOM might be prepared for a new DoD program, giving the DoD program manager a better understanding of the program he or she must manage.

Contents

Figures

Introduction

The *DoD Advanced Automation System Information Object Model* is the required deliverable for IBM STARS Task QM15, Phase II. This report is the result of the second phase of STARS QM15, where the three STARS prime contractors developed Information Object Models of their selected applications. IBM initially selected Military Air Traffic Control as its application. Our approach was to build a model of a generic military air traffic control system in the first part of phase II, and to specialize this model with a selected military air traffic control operation. After the QM15 mid-point review, IBM was directed by the government to redirect its modeling efforts to develop a DoD Advanced Automation System Information Object Model. Thus, IBM conducted two semi-related efforts in Phase II, namely: 1) building an IOM of a generic military air traffic control system and 2) building an IOM of the DoD AAS. Both of these applications certainly contained similar functionality, but addressed the problem of air traffic control with dramatically differing sets of requirements. Building the DoD AAS IOM meant the IBM team had to start their modeling efforts in the second period of phase II from scratch.

In one of our reviews with Foxboro consultant, Dr. Gerald White, IBM illustrated some problems in functional object decomposition that enabled Dr. White to recognize that there was a problem in the way we were modeling and decomposing our objects. Dr. White soon discovered that all three primes were uniforming applying what they had learned during phase I, although these practices were different than he intended. Because the major goal of QM15 was to produce an Information Object Model which was illustrative of the way Foxboro applied their methodology, we felt we should significantly revise our IOM. Hence, three weeks before the QM15 phase II final review, the IBM team rewrote its existing IOM to employ the modeling heuristics we were able to learn from Dr. White. IBM refined these modeling heuristics and presented them at the final phase II review meeting in the presentation entitled *IOM Methodology Notes*. Due to the course of our phase II effort, IBM required time in IQM15 phase III to complete portions of our IOM deliverable.

Although our DoD AAS IOM is not complete, it does illustrate the transformation modeling techniques as applied by Foxboro. Foxboro, currently, does not have a public-domain IOM available which illustrates these techniques. The IBM DoD AAS IOM is a representative example available of the application of Foxboro's techniques for building an IOM, which employs Foxboro's packaging ideas along with some IBM enhancements in presentation, real-time structured analysis and Foxboro's undocumented methodology for transformation modeling. We feel this is our contribution to STARS task QM15 and the STARS program.

In the following sections, we will discuss requirements for a DoD AAS, discuss the relationship between DoD AAS and FAA AAS, describe their similarities and differences, discuss criteria for scoping the task for producing the DoD AAS IOM and identify the criteria selected for building the DoD AAS IOM.

DoD Advanced Automation System Requirements

The DoD Advanced Automation System to support military air traffic control in the future is mandated to make use of existing FAA capabilities where ever it is possible, and to augment those capabilities to meet specific military needs. To support military air traffic control requirements will require enhancements to FAA capabilities including.

- Added surveillance capabilities
- Enhanced tracking capabilities
- Added approach control system support
- Added ground-based interrogation system support, including support for modes: 2, 3, 4, C and S
- Automation of standard voice recording

- Enhanced tower night operations support
- The ability to conduct tower and approach control in a stand-alone mode of operation, when FAA system support is unavailable.

DoD Advanced Automation System Components

The DoD Advanced Automation System is composed of:

- The FAA Advanced Automation System
- Stand-alone Tower/Terminal Remote TRACON Facilities (T/RT).

The FAA Advanced Automation System is composed of:

- Area Control Facilities (ACF) to be supported by the Area Control Computer Complex (ACCC)
- Enroute Control Centers, supported by the ACCC
- Terminal Remote Approach Control Facilities (TRACON), supported by ACCC equipment called Terminal Advanced Automation System (TAAS)
- Tower Control Centers, supported by the Tower Control Computer Complex (TCCC).

Currently the, FAA-planned T/RT depends on Area Enroute Control for:

- Real-time weather data processing
- Flight plan route processing
- Strategic prediction functions
- Long-term recording
- Training scenario generation
- Software release and adaptation data downloading.

These capabilities must be included in the DoD AAS T/RT to permit stand-alone operations.

Modeling Approach

The goal of IBM STARS task QM15 was to model the essential processing requirements for a DoD Advanced Automation System. The DoD Advanced Automation System Information Object Model is a specification model describing "what" the DoD AAS is and what it should do.

The IBM STARS task QM15 modeling approach to meet the above goals was to:

- Identify the differences between DoD AAS AND FAA AAS
- Identify any differences in the essential functionality
- Identify specific constraint requirements that need to be addressed in the implementation model
- Determine the essential processing characteristics of the DoD AAS
- Model an IOM representing the essential processing characteristics of the DoD AAS.

Examination of Basic Essential Processing Differences

The purpose of both DoD AAS and FAA AAS is to perform air traffic control. Essential processing differences do not exist, as they both address the same problems:

- Both have requirements for traffic and weather surveillance
- Both have requirements for tactical traffic prediction and strategic traffic prediction
- Both have requirements for approach control systems support.

IBM STARS made the decision to model DoD AAS, using FAA AAS as the basic model. It was our intent to address the DoD AAS constraint requirements in the DoD AAS Implementation Modeling phase; however, due the redirection of STARS, this effort is currently not planned.

Determining the Scope of Modeling Activities

FAA AAS is composed of 23 Area Control Facilities which includes:

- 1 Enroute Center per Area Control
- Multiple Approach Control Facilities per Area Control
- Multiple Tower Control Facilities per Approach Control.

Enroute Center and Approach Control facilities are identical in the processing that they must perform. Tower Control facilities perform a subset of the processing that an Enroute Center and Approach Control Facilities perform, as well as functions unique to the tower.

The processing required by the DoD AAS for the Remote TRACON Portion of a T/RT is addressed in the Area Control IOM. The processing required by the DoD AAS for the Tower Control Portion of a T/RT will be addressed in the Tower Control IOM. (NOTE: Modeling of the Tower Control IOM was to be a follow-on activity to be done in conjunction with an IOM completion/Implementation Modeling activity, and is not addressed in the Phase II DoD AAS IOM.)

The following DoD AAS requirements represent implementation issues to be addressed in the Implementation Modeling phase, namely:

- Added surveillance capabilities -- SURVEILLANCE
- Enhanced tracking capabilities -- FLIGHT PLAN AND TRACKING ANALYSIS
- Added approach control system support -- TOWER CONTROL
- Added ground-based interrogation system support for modes 2, 3, 4, C and S -- SURVEILLANCE
- Automation of standard voice recording -- RECORDING SUPPORT
- Enhanced tower night operations support -- TOWER CONTROL.

Modeling Scope for the DoD AAS Model

The DoD AAS Model requires two IOMs: One for Area Control and one for Tower Control. Due to the limitation of time and resources, and our re-direction from military air traffic control to DoD AAS, IBM STARS Task QM15 concentrated its efforts on modeling the Area Control IOM. The Tower Control IOM and the DoD AAS Implementation Model were to be addressed in future phases, however, based on customer re-direction of STARS, these efforts are not currently planned.

Mission Statement for the DoD Advanced Automation System

The proposed mission of a DoD Advanced Automation System is to provide automated support for operational Military Air Traffic Control. DoD Advanced Automation System shall use existing FAA system capabilities and be able to operate autonomously.

The area control for the DoD Advanced Automation System will monitor and control an area of defined air space. Tower control for the DoD Advanced Automation System will control airport ground operations. The DoD Advanced Automation System will provide for the safe and timely departure and arrival of military controlled flights.

System flow control shall be aided from both the FAA national flow controller and the FAA and DoD area flow controllers. They will provide military controllers with airspace traffic advisories and recommendations on areas of congestion to avoid, for managing military flight operations.

The DoD Advanced Automation System will provide monitoring of aircraft positions in relation to other aircraft traffic, terrain and weather conditions within a defined air space. The system will also support the management and control of special use airspace, as required. The system surveillance capability shall include primary target identification and secondary target identification, supported by ground based interrogation systems. Weather surveillance shall be supported by the primary surveillance systems, augmented by weather surveillance systems. Further, the DoD Advanced Automation System will provide strategic and tactical prediction capabilities for performing air space collision situation assessment to identify short-term and mid-term situations for Military Air Traffic Control personnel to assess and act upon.

Area Control for the DoD Advanced Automation System will provide the functionality included for both an FAA Enroute Center and a Terminal Remote Approach Control (TRACON). The Area Control for the system will provide:

- for the sequencing and separation of aircraft;
- navigation instructions to avoid identified situations (e.g. aircraft-to-aircraft traffic conflicts, aircraft-terrain conflicts, hazardous weather, terrain obstacles, etc.);
- for the tracking of controlled aircraft against filed flight plans;
- navigation instructions to aircraft as requested.

Tower Control for the DoD Advanced Automation System will include the functionality similar to FAA Tower Control Systems. This system provides for the control of ground travel and issuance of takeoff/landing clearances.

A DoD Advanced Automation System will:

- accept, process, allow in-flight modification and closeout of flight plans;
- provide communication between controller and aircraft;
- provide weather information and re-route controlled traffic accordingly;
- provide traffic re-routing due to exceptional conditions (e.g. aircraft emergency, airport closing, etc.);

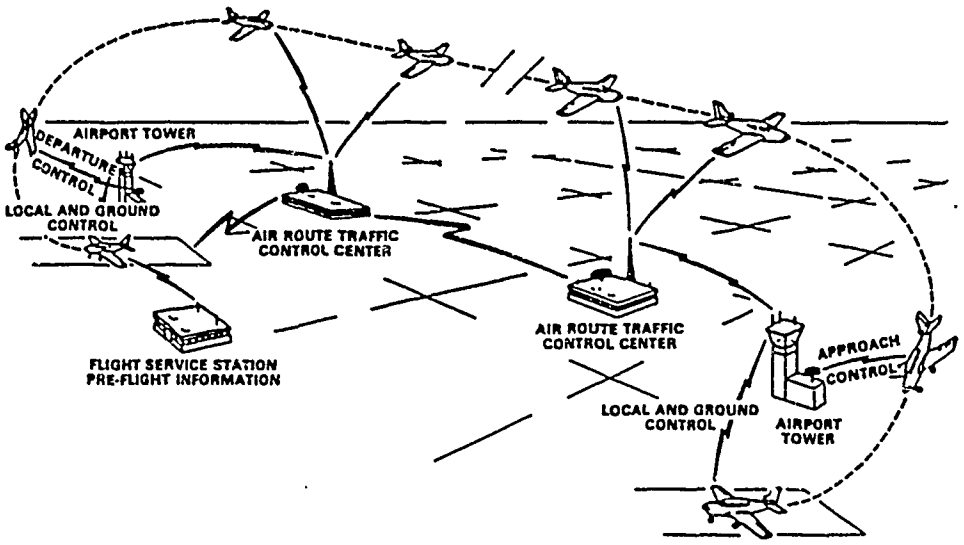
A typical scenario for operating an aircraft under the guidance of a a DoD Advanced Automation System for Air Traffic Control involves the following:

- Pre-Flight
  - Flight plan entry
- Departure (Tower/Area)

  - Push back clearance
  - Taxi clearance
  - Take-off clearance
- In-Flight (Area)
  - Spacing, monitoring, and tracking of aircraft
- Approach (Area)
  - Sequencing and spacing of aircraft to determine landing order
- Landing (Area/Tower)
  - Landing clearance
  - Taxi clearance
  - Docking clearance
- Post-Flight
  - Close-out flight plan

This scenario is depicted in Figure 1 on page 6.

FLYING THROUGH THE NATIONAL AIRSPACE SYSTEM



OPERATIONS OFFICE	TOWER	TRACON	ARTCC	TRACON	TOWER	OPERATIONS OFFICE
PREFLIGHT	DEPARTURE	CLIMB OUT	ENROUTE	APPROACH	LANDING	POSTFLIGHT
Flight Plan Entry	ATC Clearance	Flight Monitoring	Flight Monitoring	Flight Monitoring	Flight Monitoring	Flight Plan Close-out
• Pre-Stored • Flight Service Station • Military Base Operations • Airline Dispatch	• Surface Operation • Taxi Routing and Control •Take-Off Clearance	• Conflict • Terrain Avoidance • Weather Avoidance • In-Trail Spacing	• Conflict • Terrain Avoidance • Weather Avoidance • Metering	• Conflict • Terrain Avoidance • Weather Avoidance • Sequencing and Spacing	• Spacing • Terrain Avoidance • Landing Clearance • Taxi Routing and Control • Surface Operation	
	Transfer of Control	Transfer of Control	Transfer of Control	Transfer of Control		

Figure 1. Flying through the National Airspace. This figure illustrates a typical scenario for operating an aircraft under the guidance of a a DoD Advanced Automation System for Air Traffic Control.

Overview of DoD Advanced Automation System

The DoD Advanced Automation System can be characterized as three subsystems. These are:

- National Flow Control (level 0 (layer 3.5) of the DoD AAS)
- Area Control Facility (level 1 (layer 3) of the DoD AAS)
- Tower Control Facility (level 1 (layer 3) of the DoD AAS).

The system context diagram for the DoD AAS is presented in Figure 2 on page 8 This figure illustrates the system boundaries for the DoD Advanced Automation System and its interfaces.

Figure 3 on page 9 illustrates the layered view of the DoD Advanced Automation System and provides the view of the functional objects inside the DoD Advanced Automation System. This layered view illustrates the major functional objects of the DoD AAS and their place in the functional object hierarchy (also known as the *functional object tree*), based on their "White Layered Model" capabilities and roles. The "White Layered Model" will be described in the IQM15 Phase III deliverable.

The top functional object of the DoD AAS functional object tree is the National Flow Controller which is illustrated in Figure 4 on page 11 The functional object tree for the DoD AAS identifies the *National Flow Control Diagram* as DoD AAS level 1. Figure 5 on page 13 illustrates the *Area Control Facility and Tower* diagram, which is identified as DoD AAS level 2 on the functional object tree.

Figure 6 on page 14 provides the system context for the Area Control Facility and Figure 7 on page 15 provides the system context for the Tower Control Facility.

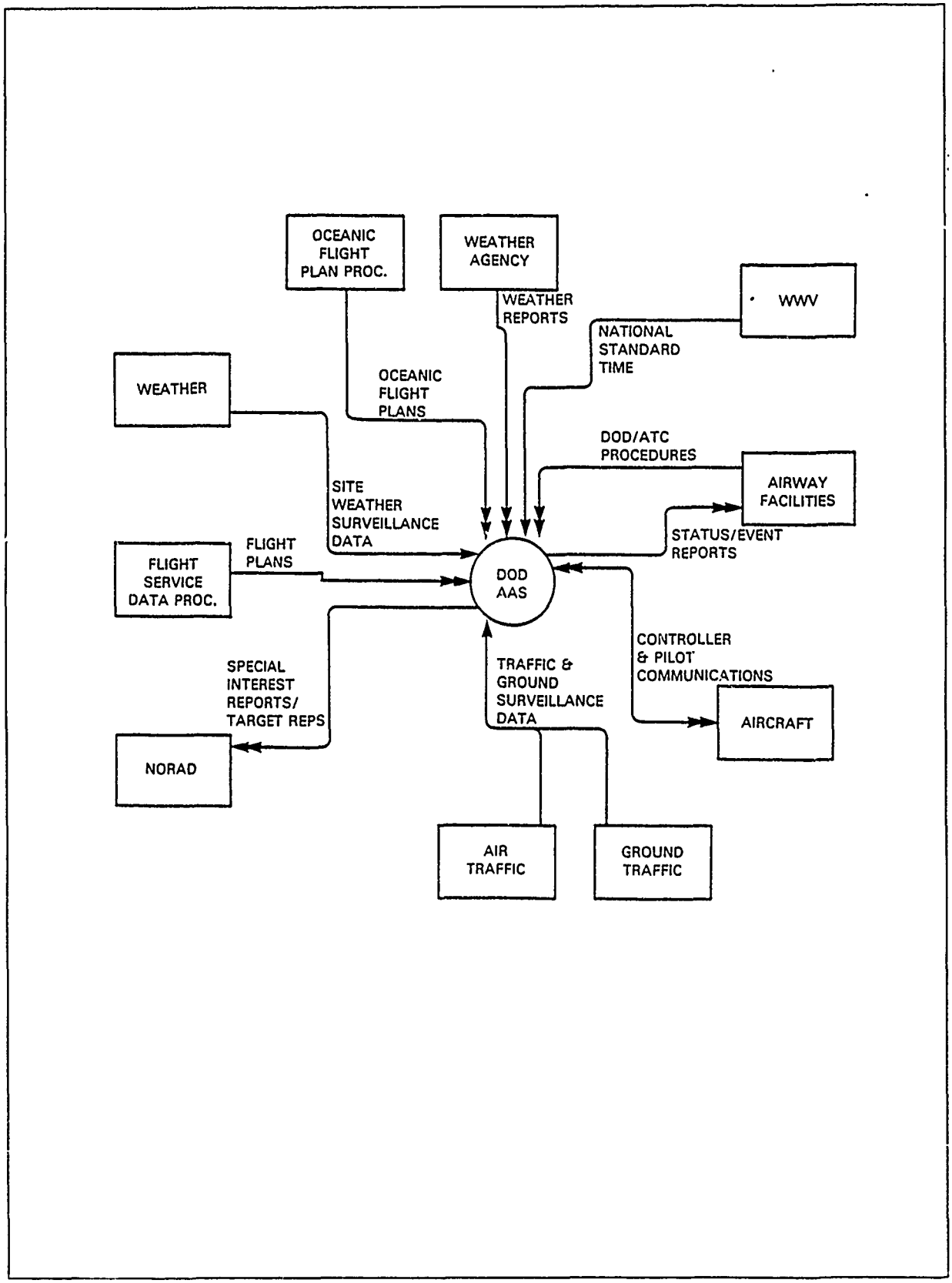


Figure 2. DoD Advanced Automation System Context Diagram. This figure shows the system context for the DoD AAS and the information flow to and from its interfaces.

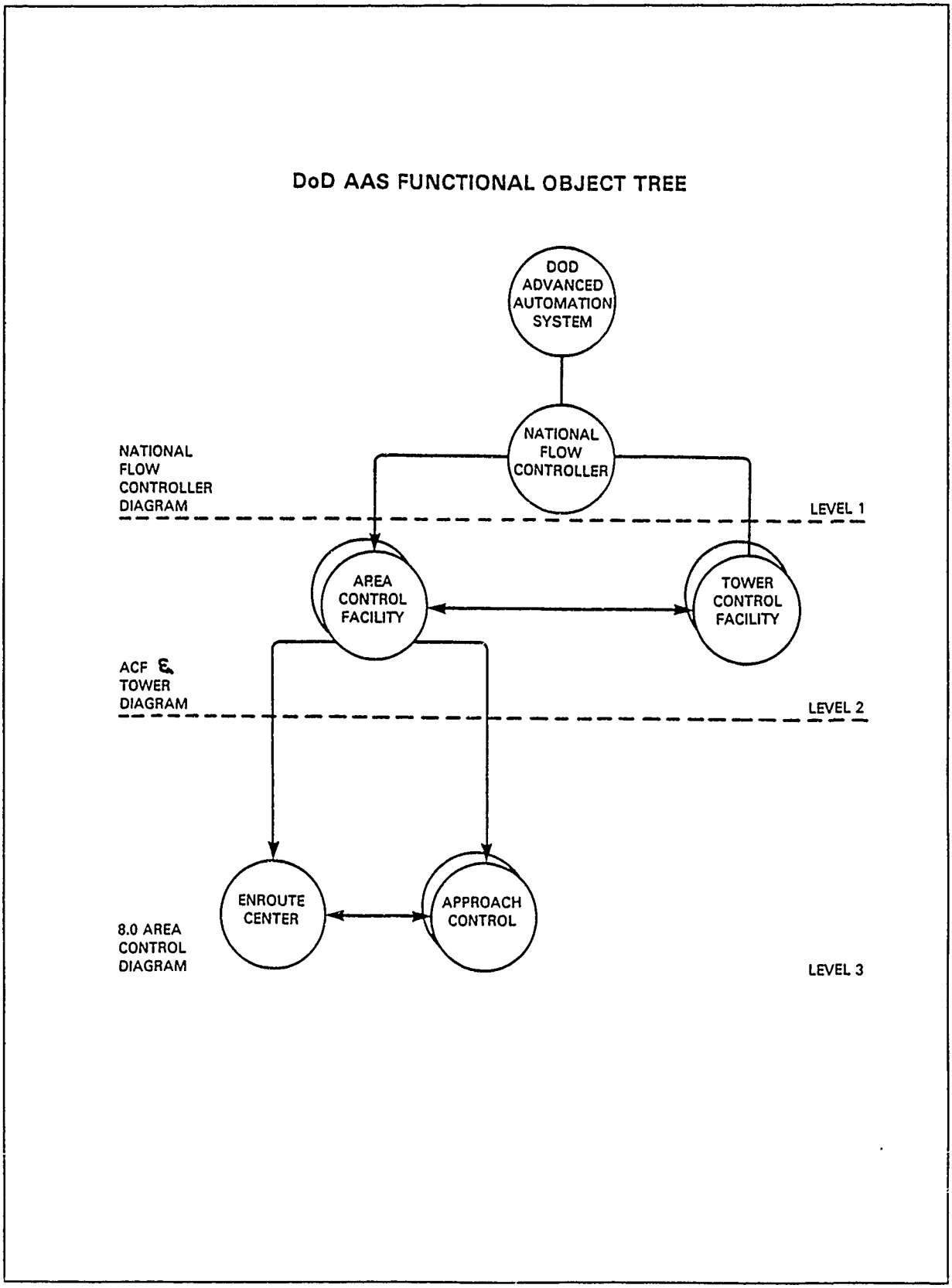


Figure 3. DoD Advanced Automation System Functional Object Tree. This figure shows the major functional objects of the DoD Advanced Automation System and their hierarchical relationship to one another. These objects are layered, based on their functional capabilities.

National Flow Controller

The Area Control Facilities shall interface with the National Flow Controller through an X.25 packet switching system called the NADIN. The National Flow Controller is the focal point for the management of nationwide air traffic flow. The National Flow Controller receives flight plans (including VFR flight plans for adapted airports), arrival and departure messages, flight plan amendments (including changes to bulk store and proposed flight plans), expected departure clearance times (EDCT), cancellations, metering and data block information, flow restrictions, the status of local metering, changes in area control facility (ACF) sector capacity and configuration (including fix and airway capacities), traffic statistics, and airport configuration and capacity data for adapted airports.

The National Flow Controller transmits arrival and departure demand lists, altitude reservations (ALTRV), airport reservation lists, alerts where projected demand exceeds capacity (i.e. for arrivals, departures, sectors, airways and fixes), expected departure clearance times, and track position and data block information (for adjacent Area Control Facilities). Figure 4 on page 11 illustrates the information flow to and from the National Flow Controller.

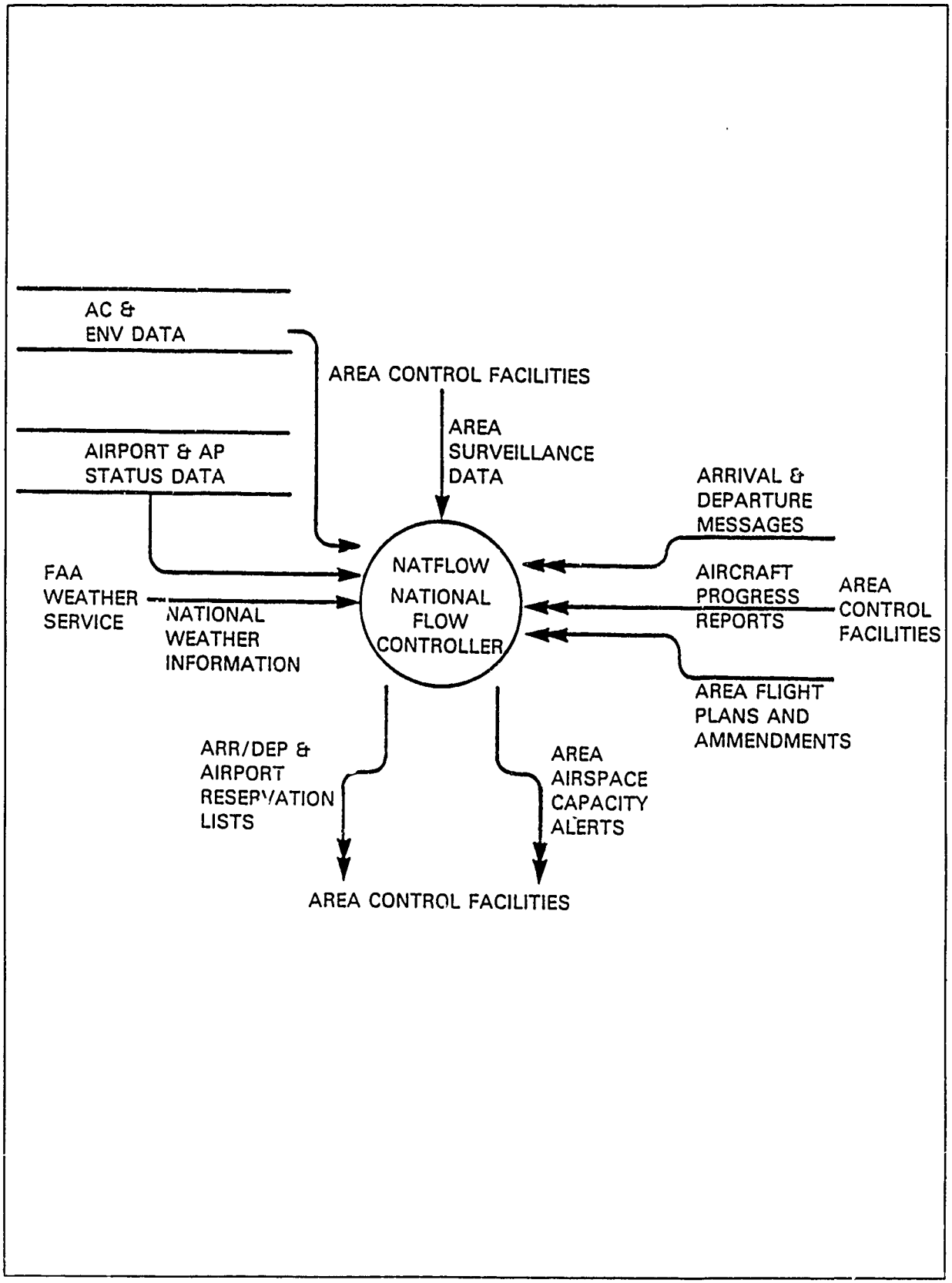


Figure 4 National Flow Controller. This figure shows the information flow between the National Flow Controller and the Area Control Facility, illustrated at a subordinate level in Figure 5 on page 13.

IOM Diagram Note

Note in Figure 4 on page 11, that information flows to and from its subordinate object, the Area Control Facility. In a structured analysis representation, this would not be proper. Since the National Flow Controller is responsible for monitoring a picture of the national airspace, it receives traffic and weather surveillance data from the Area Control Facilities, along with flight information. In turn, the National Flow Controller "controls" Area Control Facilities operations by providing them with airspace capacity alerts, based on national traffic projections.

It is the hierarchic organization of objects, based on their capabilities, and the information and control messages passed to subordinate objects that makes the IOM transformation modeling unique.

It should also be noted that the National Flow Controller, as an object, performs work. Its subordinate objects may or may not represent its decomposition. In the case presented in Figure 4 on page 11, the Area Control Facility and Tower Control Facility are not functions of the National Flow Controller, in a decomposition sense. However, from a control as well as functional capability standpoint, they are subordinate to the National Flow Controller. As all "functional" objects must perform work, (thus the term functional), some constructions will appear incorrect to practitioners of structured analysis, but from an IOM modeling standpoint, they are perfectly reasonable.

Area Control Facility and Tower Control Facility

Figure 5 illustrates the information flow to and from the Area Control Facility and the Tower Control Facility, and to the National Flow Controller.

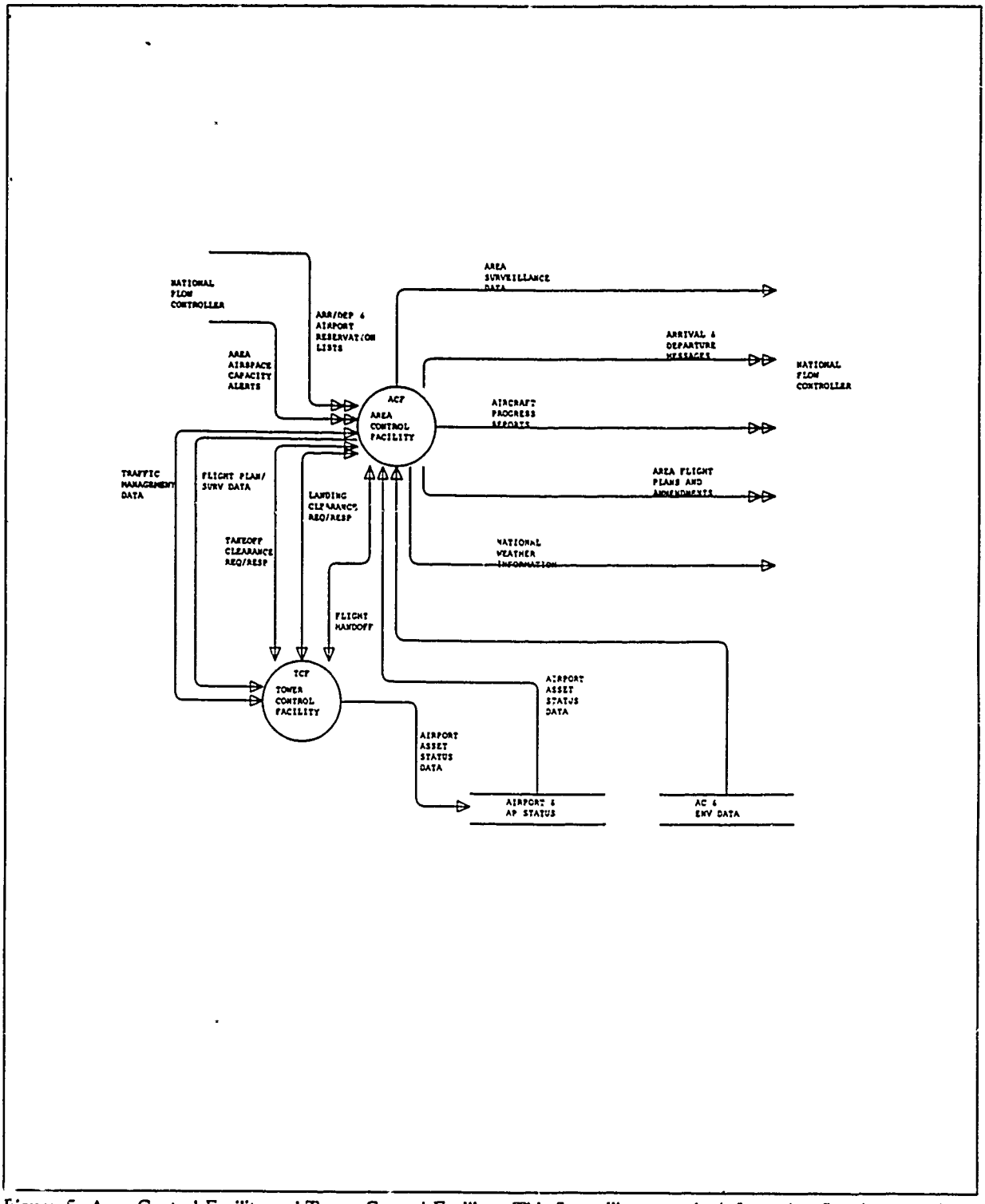


Figure 5. Area Control Facility and Tower Control Facility. This figure illustrates the information flow between the National Flow Controller and the Area Control Facility, illustrated at a subordinate level in Figure 5.

DoD AAS Area Control Facility Context

Figure 6 illustrates the system boundaries for the DoD AAS Area Control Facility and its interfaces. The DoD AAS Area Control Facility is the first of two subordinate Information Object Models required to describe the DoD AAS. As discussed previously, the focus of the remainder of this document in on the DoD AAS Area Control Facility.

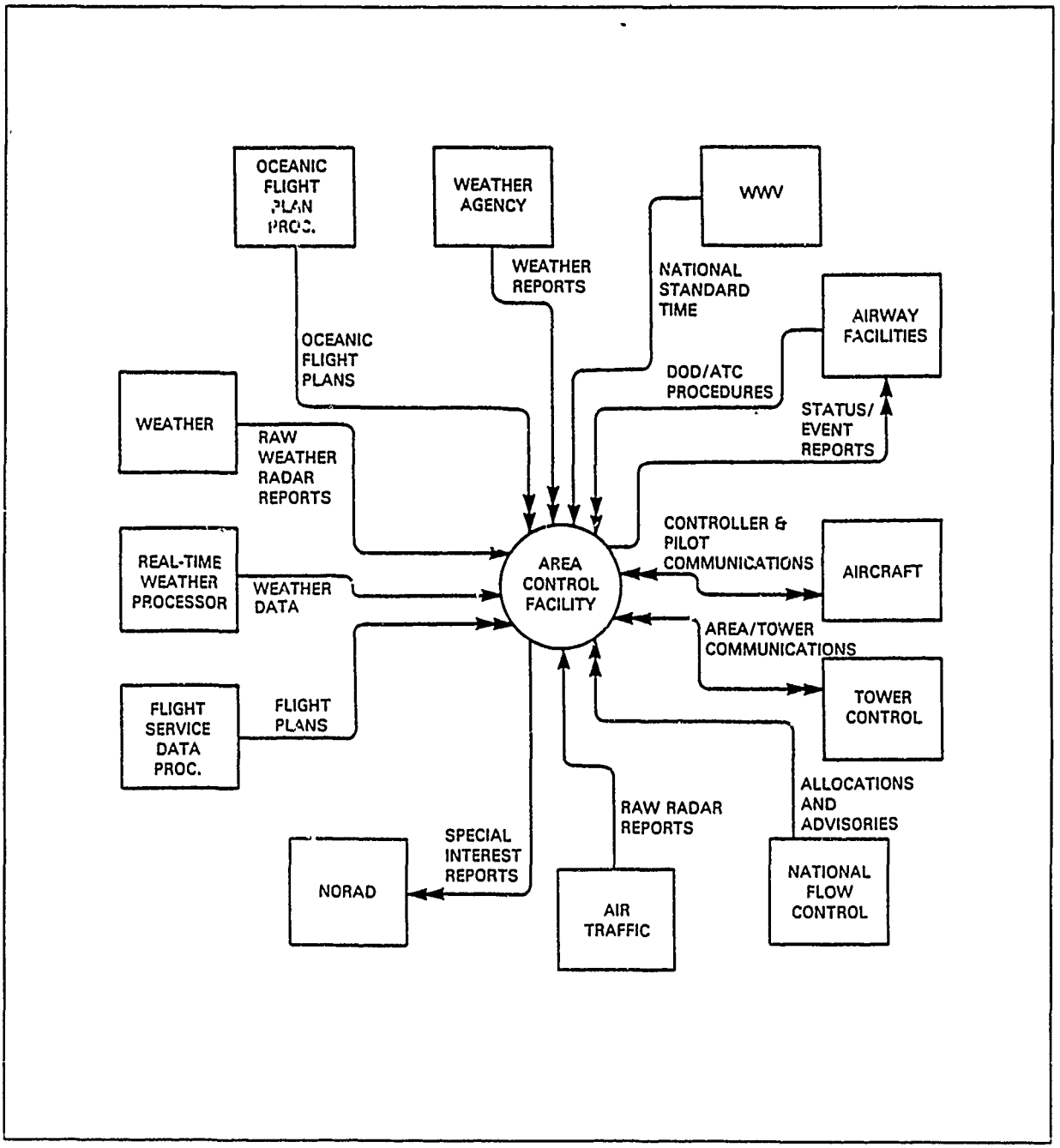


Figure 6. DoD AAS Area Control Facility Context Diagram. This figure shows the system context for the DoD AAS Area Control Facility and the information flow to and from its interfaces.

DoD AAS Tower Control Facility Context

Figure 7 illustrates the system boundaries for the DoD AAS Tower Control Facility and its interfaces. The DoD AAS Tower Control Facility IOM is the second of two subordinate Information Object Models required to describe the DoD AAS. As discussed previously, the focus of the remainder of this document in on the DoD AAS Area Control Facility. This diagram is included for reference.

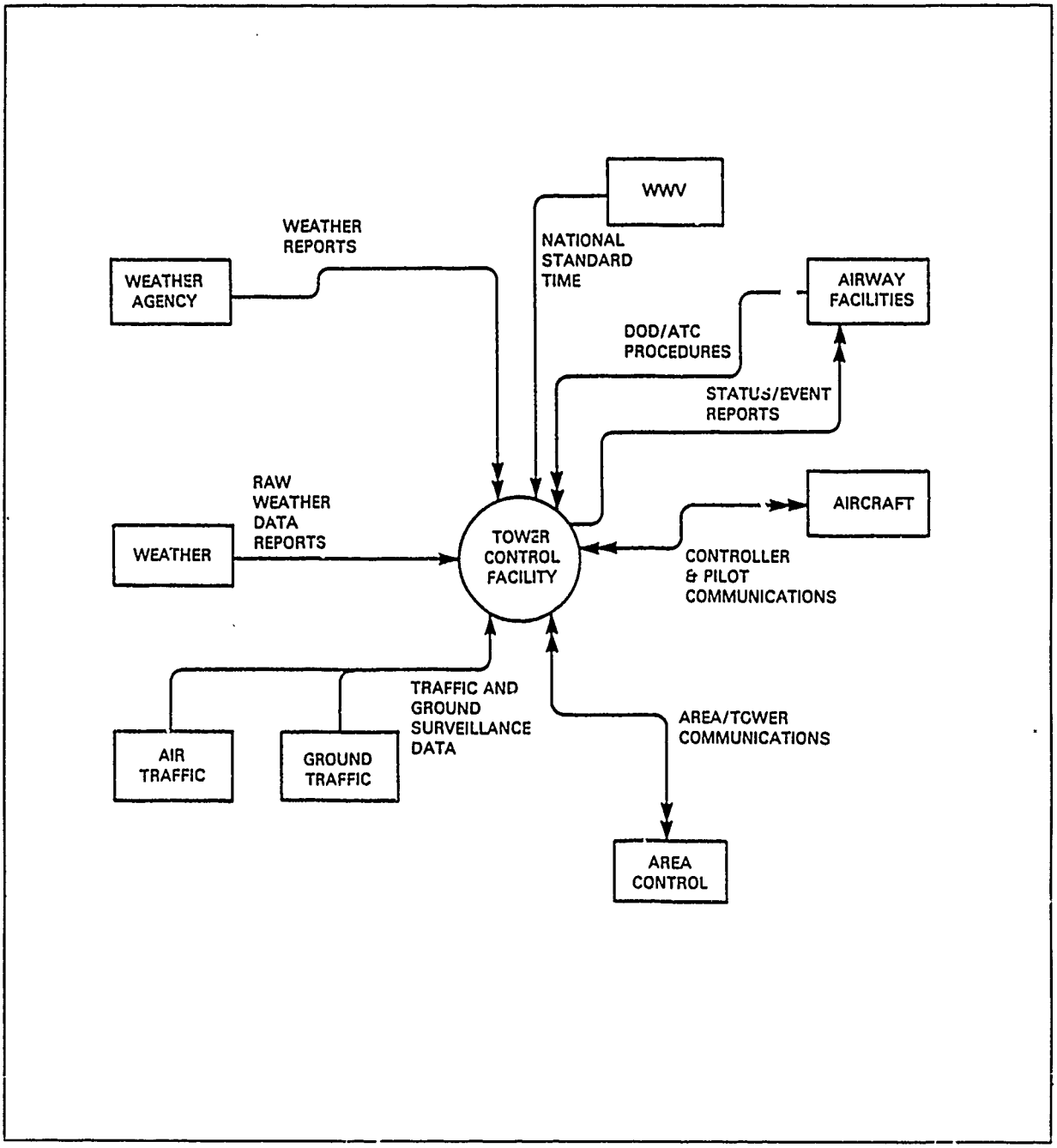


Figure 7. DoD AAS Tower Control Facility Context Diagram. This figure shows the system context for the DoD AAS Tower Control Facility and the information flow to and from its interfaces.

Overview of Area Control Facility

The focus of the remainder of this document will be on the DoD AAS Area Control Facility, as this is the area we chose to develop in scoping the DoD AAS modeling effort. DoD AAS can best be represented by three Information Object Models:

- DoD AAS IOM, which was informally presented in the previous section,
- DoD AAS Area Control Facility IOM
- DoD AAS Tower Control Facility IOM.

This allocation was selected because of the requirements for modeling an IOM. As all functional objects must perform one or more functions, and traditional functional decomposition to functional primitives is not allowed, this approach was necessary. Traditional structured analysis transformation diagram decomposition permits processes which are "hollow" in that the process bubble represents an encapsulation of functions described at lower levels. In IOM transformation diagram decomposition, all functional objects and the processes used to describe the functions, must perform work. The method we chose of partitioning DoD AAS into three IOMs was the most practical solution that we found to adhere to the IOM modeling rules.

Major Functional Objects for the Area Control Facility IOM

The Area Control Facility Information Object Model can be functionally described as a collection of eight different areas, namely:

1. Traffic Surveillance
2. Weather Surveillance
3. Aircraft and Track Management
4. Recording Support
5. Prediction and Resolution
6. Flight Plan Entry Support
7. Flight Plan Operations Support
8. Area Control.

Figure 8 on page 18 identifies the eight functional areas and illustrates the information flow between the functional areas. The system as described must interact with external factors, which are illustrated in Figure 9 on page 19. These external factors are:

1. Information input:
   - Weather
   - Real-time weather processor
   - Weather agency
   - Flight service data processing
   - Oceanic Flight Data Processing
   - Air traffic
   - WWV
   - National Flow Control

- National Flow Control

2. Information Output:
   - NORAD
3. Information Input and Output
   - Tower Control
   - Aircraft
   - Airway Facilities.

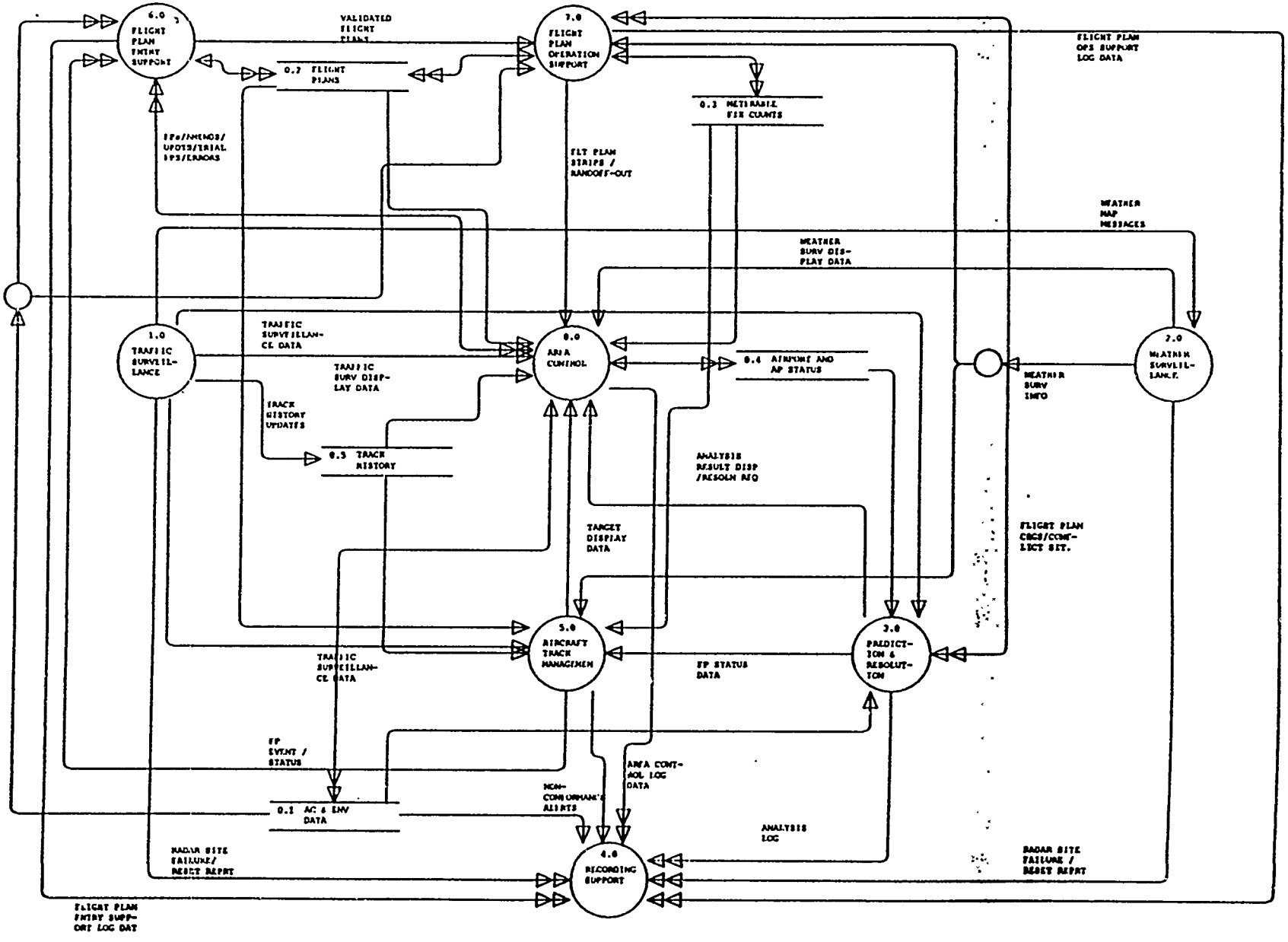


Figure 8. DoD AAS Area Control Facility. This figure illustrates the major functional objects of the DoD AAS Area Control System. The figure also illustrates the information flows between these objects.

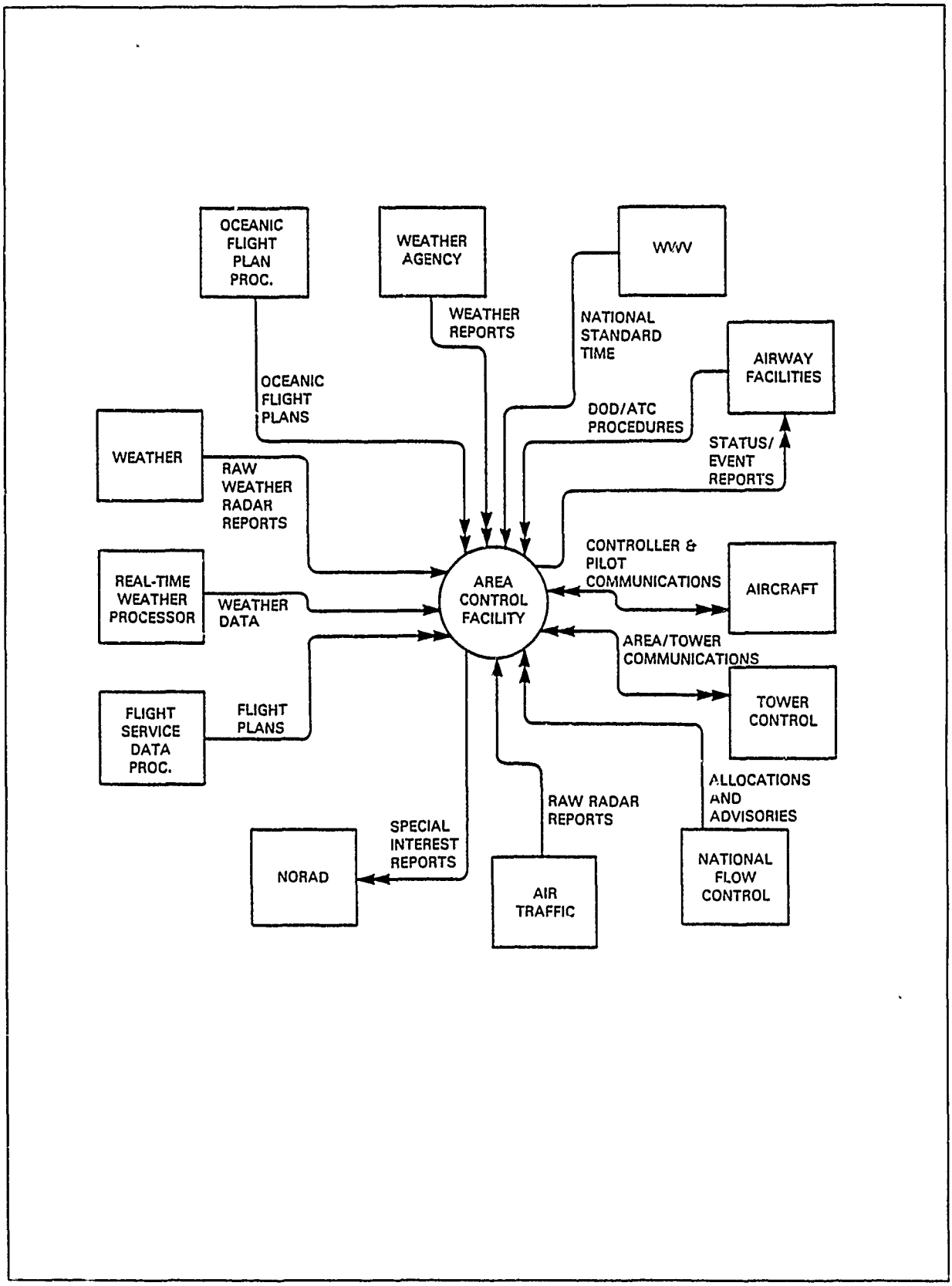


Figure 9 DoD AAS Area Control System Context Diagram. This figure illustrates the external factors which the Area Control System must interface. The diagram also establishes the system boundary for the Area Control System and illustrates the information flow between external interfaces.

1.0 Traffic Surveillance

The 1.0 TRAFFIC SURVEILLANCE object shall present to air traffic controllers, a consistent view of traffic conditions in a given sector of airspace. This view of traffic conditions will be provided from raw sensor data collected from both primary and secondary radar systems and processed to filter and present radar information to air traffic controllers.

2.0 Weather Surveillance

The 2.0 WEATHER SURVEILLANCE object shall present to air traffic controllers, an integrated picture of weather conditions, overlayed with information from flight plan processing and the prediction and resolution function. This view of weather conditions will be provided from raw sensor data collected from both primary and secondary radar systems and processed to filter and present radar information to air traffic controllers.

3.0 Prediction and Resolution

The 3.0 Prediction And Resolution object shall perform all tactical and strategic prediction and resolution of conflicts. Tactical prediction and resolution is based on realtime flight surveillance data. It is concerned with identifying imminent conflicts and does so by analyzing current and historical flight path data. Any conflict arising in the next few minutes is identified to the Controller, along with a list of possible evasive maneuvers. Possible conflicts are between aircraft and aircraft, or between aircraft and the ground.

Strategic prediction and resolution functions are concerned with future conflicts, and these functions base their analysis on recorded flight plan data. Using the flight plan data, this function will simulate airspace into the future to predict aircraft to aircraft and aircraft to ground conflicts. This function will also predict if too many planes are entering a window of airspace within a certain time window. Identified conflicts are presented to the Controller, who has the option of requesting resolution of identified conflicts in the form of updated flight plans.

4.0 Recording Support

4.0 Recording Support object shall provide the air traffic control system the ability to log required system data. Recording Support contains the recording of air traffic management data, system hardware and software diagnostic and performance information, and data to determine flight monitoring statistics.

Air traffic management data includes activity counts taken within air traffic control sectors. These counts include:

- Number of IFR aircraft and controller VFR aircraft
- Adapted routes
- Speed distribution
- Altitude distribution
- Number of arrivals
- Number of departures
- Number of overflights
- Number of flight plans

- Number of separation incidents.

Flight monitoring statistics shall be recorded to determine the average times and speeds of flights within sectors and sectors traversed per flight.

5.0 Aircraft and Track Management

The 5.0 Aircraft and Track Management object shall perform the function of correlating identified aircraft surveillance tracks to flight plans recorded in the database. For tracks with identified flight plans, any flight plan milestone is recorded, including metering fix crossings.

6.0 Flight Plan Entry Support

The 6.0 Flight Plan Entry Support object shall provide a single point in the system for the entry of and updates to flight plans. Four types of flight plan entries/updates will be processed: initial flight plans and amendments, up-route and trial flight plans, updates to flight plan times (actual and estimated) or status, and handoffs of flight plans entering the air space.

There are five databases which are updated by the Flight Plan Entry Support object. The Inactive Flight Plan Database contains flight plans which have been entered into the system, but which have not yet departed. When a flight departs, it is moved to the Active Flight Plan Database. Flights which are currently active in up-route centers are kept in the Up-Route Active Flight Plan Database. Trial flight plans are kept in the Trial Flight Plan Database. When they have been approved by the controller, they are moved to the Active Flight Plan Database or the Inactive Flight Plan Database as appropriate. Flight plans received in bulk are stored in the Bulk Flight Plan Database until needed.

When the Flight Plan Entry Support object receives a new flight plan, a bulk flight plan, or an amendment to a flight plan (to either an active or inactive flight), syntax checking and geographical checking is performed. If an error exists, the enterer of the flight plan is notified. Otherwise, the flight plan is stored in the appropriate database. Bulk flight plans are stored in the Bulk Flight Plan Database until an adapted amount of time prior to departure. At this time, they are sent to Flight Plan Operation Support for further route processing.

When trial or up-route flight plans are received, they are stored in the appropriate databases, and Flight Plan Operation Support is notified.

When an update to an estimated or actual time in a flight plan is received, or a change to a flight plan status is received, the appropriate flight plan database is updated, and Flight Plan Operation Support is notified.

When a handoff coming into the center is received, the controller is notified. When the controller receives the handoff, the flight plan is deleted from the Up-Route Flight Plan Database, and entered in the Active Flight Plan Database.

7.0 Flight Plan Operation Support

The 7.0 Flight Plan Operation Support object shall perform three functions: expand the route in a flight plan, update fix data when an estimated or actual time in a flight plan changes, and generate strips and handoff requests.

An adapted time prior to departure, the route of a flight plan is expanded to include all fixes along the route. This processing may be repeated after departure if the flight plan is amended.

Every time a time in a flight plan is modified (either an actual or an estimated time), the fix data for that flight plan is recalculated. The fix data includes the estimated time of arrival at each fix and the destination, as well as the Meterable Fix Counts Database.

At an adapted time prior to arrival at a center or sector, a strip is generated for that center or sector. Also, at an adapted time prior to arrival at a center or sector, a handoff request is generated and sent to the receiving center or sector.

8.0 Area Control

The 8.0 Area Control object shall be responsible for airspace management, which includes monitoring defined areas of airspace, and controlling air traffic, under Area Control. Further, it shall provide Area Flow Control, which will interface with the National Flow Controller, for the effective and safe utilization of airspace and managing airspace congestion.

The 8.0 AREA CONTROL object encapsulates the functions of the Enroute and Approach Control Facilities.

Information Object Models (IOM)

This section provides the Information Object Models for the major functional objects. The functional objects presented are:

- 1.0 Traffic Surveillance
- 2.0 Weather Surveillance
- 3.0 Prediction and Resolution
- 5.0 Aircraft and Track Management
- 6.0 Flight Plan Entry Support
- 7.0 Flight Plan Operation Support
- 8.0 Area Control
- 4.0 Recording Support.

Functional objects 8.0 Area Control and 4.0 Recording Support are included, but are not complete. They were prepared from existing documentation and the materials prepared for the final review. Personnel assigned to these sections were reassigned after the the QM15 final review, and were unable to finish documenting their sections.

1.0 Traffic Surveillance

Introduction

The Traffic Surveillance object is responsible for providing air traffic surveillance information to Area Control for final processing to display an integrated view of air traffic to air traffic controllers.

The TRAFFIC SURVEILLANCE object will be introduced by four graphics, namely:

- The Traffic Surveillance View From
- The Traffic Surveillance Interfaces
- The Traffic Surveillance Functional Object Tree
- Traffic Surveillance.

1.0 Traffic Surveillance "View From"

The DoD AAS Area Control view from 1.0 TRAFFIC SURVEILLANCE is illustrated by Figure 10 on page 25. The "view from" presents all of the major functional objects of the DoD AAS Area Control and their relationship to TRAFFIC SURVEILLANCE by the messages that are passed to and from it.

The TRAFFIC SURVEILLANCE object provides traffic surveillance data to following objects: 1) 5.0 Aircraft and Track Management, 2) 3.0 Prediction and Resolution, 3) 4.0 Recording Support, and 4) 8.0 Area Control. Traffic Surveillance also provides weather map messages to weather surveillance for weather surveillance processing. Finally Traffic surveillance updates the track history database for reference by other objects.

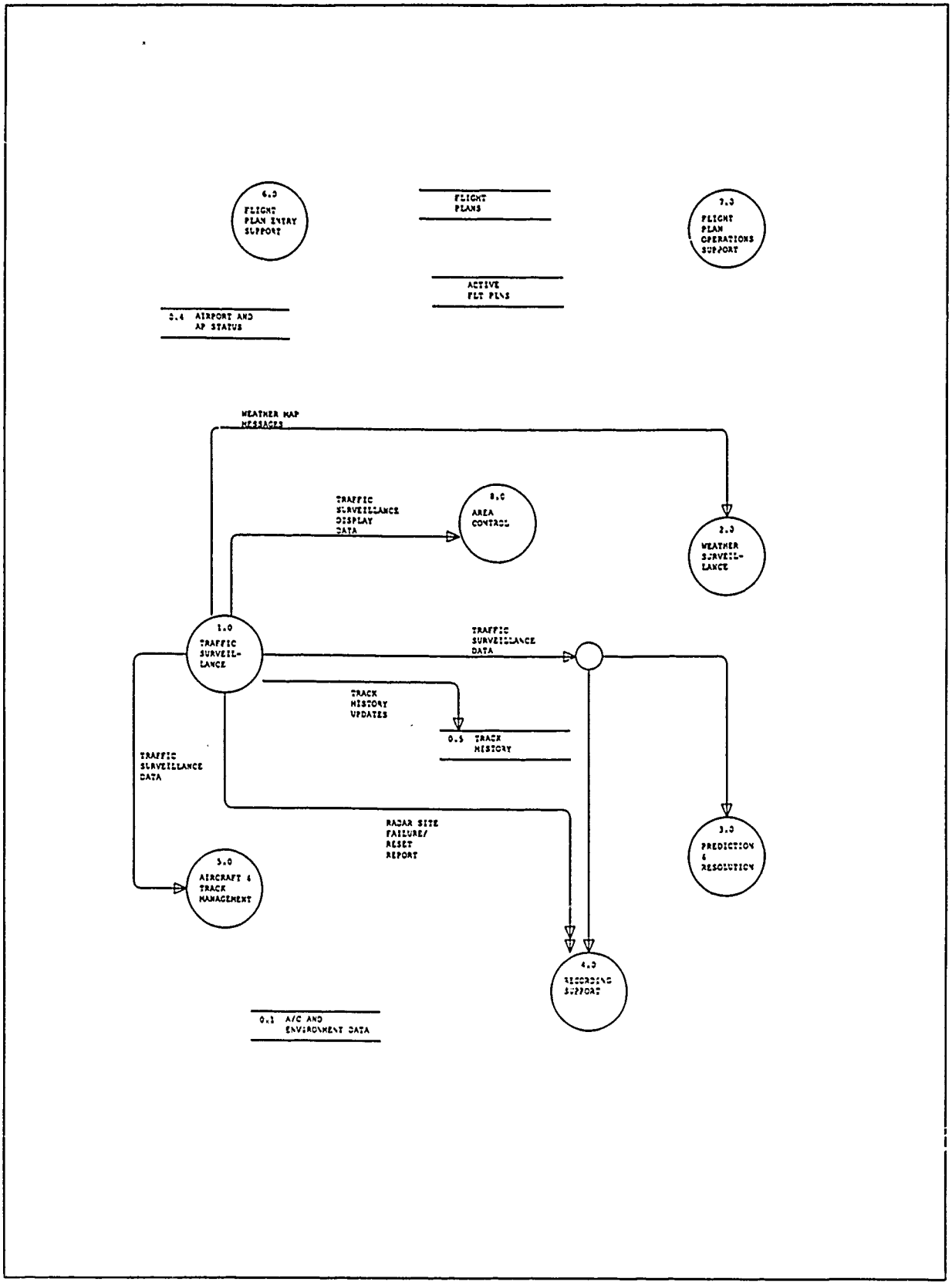


Figure 10. DoD AAS Area Control View from Traffic Surveillance. This figure illustrates the view of DoD AAS Area Control with respect to TRAFFIC SURVEILLANCE. This diagram also presents all of the major functional objects of the DoD AAS Area Control IOM and the message "pipes" that connect them to TRAFFIC SURVEILLANCE.

1.0 Traffic Surveillance Interfaces

The interfaces to TRAFFIC SURVEILLANCE are illustrated on Figure 11 on page 27. It provides traffic surveillance data to object's Prediction and Resolution, Aircraft and Track Management, and recording support. Traffic surveillance display data is sent to Area Control. Radar Site Failure/Reset reports are send to Recording support for logging. Track History Updates are recorded in the Track History database for future reference by other objects. Weather Map Messages are sent to weather surveillance for assembling a view of the weather for presentation by Area Control. Traffic Surveillance receives Raw Radar Returns from air traffic surveillance radars.

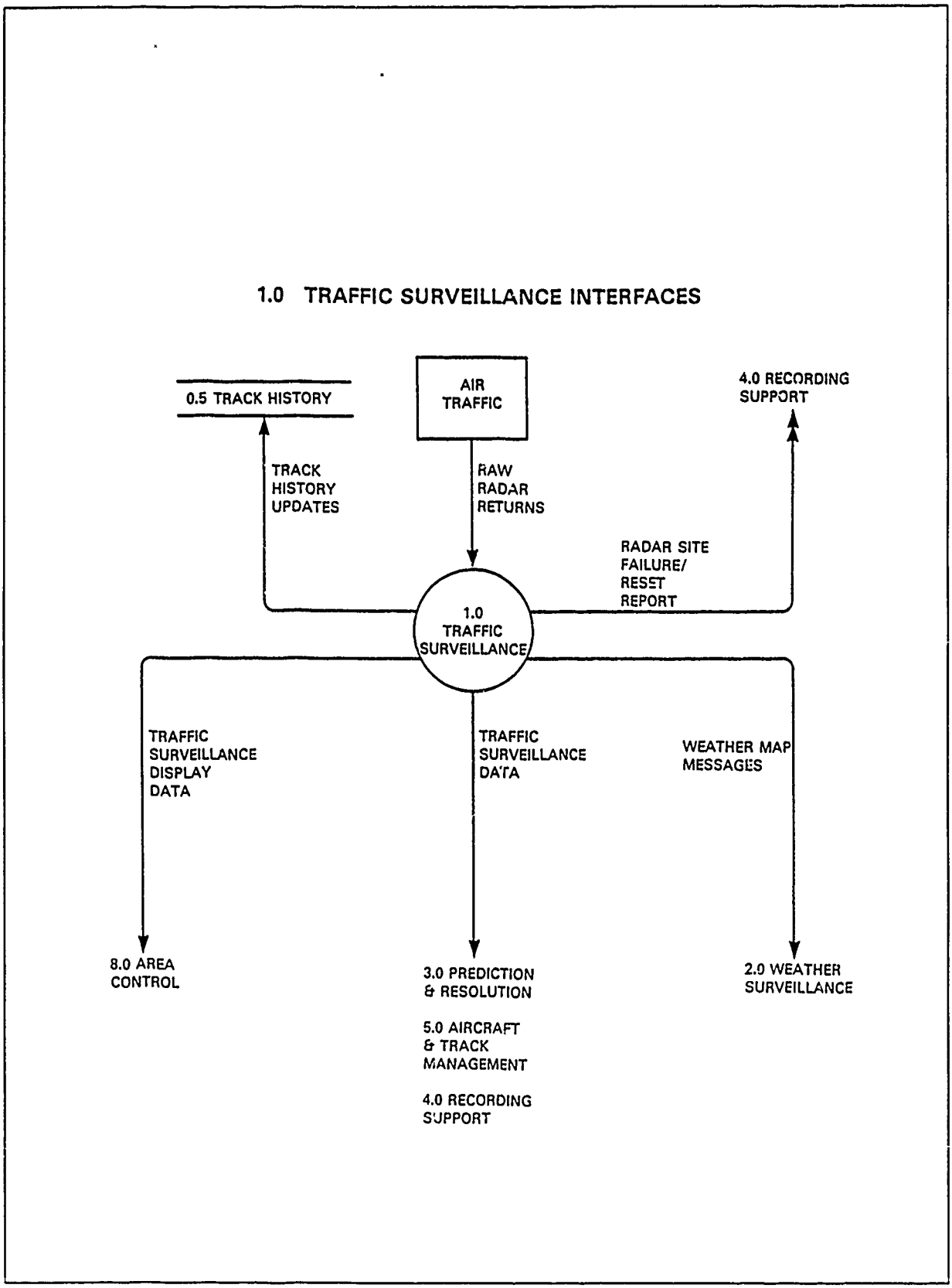


Figure 11. Interfaces for 1.0 TRAFFIC SURVEILLANCE. This figure illustrates the interfaces of the the 1.0 Traffic Surveillance functional object. This diagram shows the major inputs from other DoD AAS Area Control functional objects and external interfaces.

1.0 Traffic Surveillance Inputs

Traffic surveillance inputs are provided from external sensors to the traffic surveillance object, thus they are not displayed on the "view from" which only shows communications inside the DoD AAS Area Control IOM. Sensor input is received in the form of raw radar data and radar codes from primary and secondary traffic surveillance radars.

1.0 Traffic Surveillance Outputs

- WEATHER_MAP_MESSAGES - Weather radar messages that have been prepared by the air traffic surveillance radar sites;
- TRAFFIC_SURV_DISPLAY_DATA - Normalized traffic surveillance data sent to Area Control for display processing;
- TRAFFIC_SURVELLANCE_DATA - Radar surveillance data of air traffic that has been normalized for further processing and use by other ATC subsystems;
- TRACK_HISTORY_UPDATES - Aircraft target track messages are stored in the TRACK_HISTORY database for reference by other ATC subsystems;
- RADAR_SITE_FAILURE/RESET_REPORT - Radar action reports sent to RECORDING SUPPORT for event logging and further action. Reports are sent upon radar state change;

1.0 Traffic Surveillance Functional Object Tree

The functional object tree for 1.0 TRAFFIC SURVEILLANCE presents the object hierarchy of TRAFFIC SURVEILLANCE, as illustrated in Figure 12 on page 29 The functional object tree presents all of the graphics used to describe TRAFFIC SURVEILLANCE, as well as the message communication paths that show communication between peer objects, parent objects to child objects, and child to parent objects.

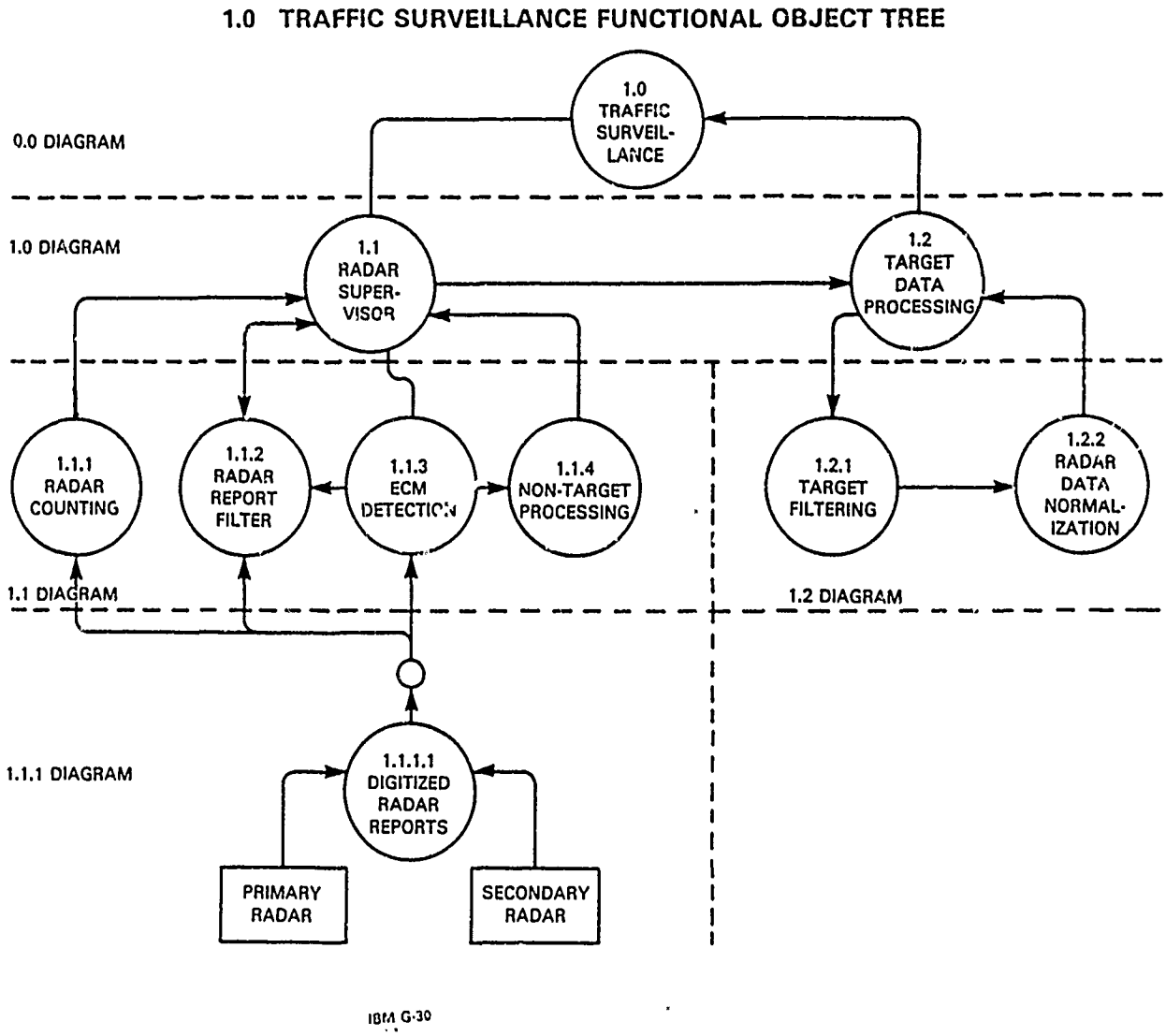


Figure 12. Functional Object Tree for 1.0 Traffic Surveillance. This figure illustrates the functional object tree for the TRAFFIC SURVEILLANCE functional object. This tree shows the hierarchic relationship between the subordinate functional objects and shows message passing between peer objects, parent objects and child objects on different levels; It also identifies the communication paths between the decomposition levels.

1.0 Traffic Surveillance Discussion

The purpose of TRAFFIC SURVEILLANCE is to present to air traffic controllers a consistent view of traffic conditions in a given sector of airspace. This view of traffic conditions is provided from raw sensor data collected from both primary and secondary radar systems and processed to filter and present radar information to air traffic controllers. TRAFFIC SURVEILLANCE is illustrated in Figure 13 on page 31. The major roles of traffic surveillance are:

- Aircraft surveillance
- Weather clutter identification
- ECM jamming identification.

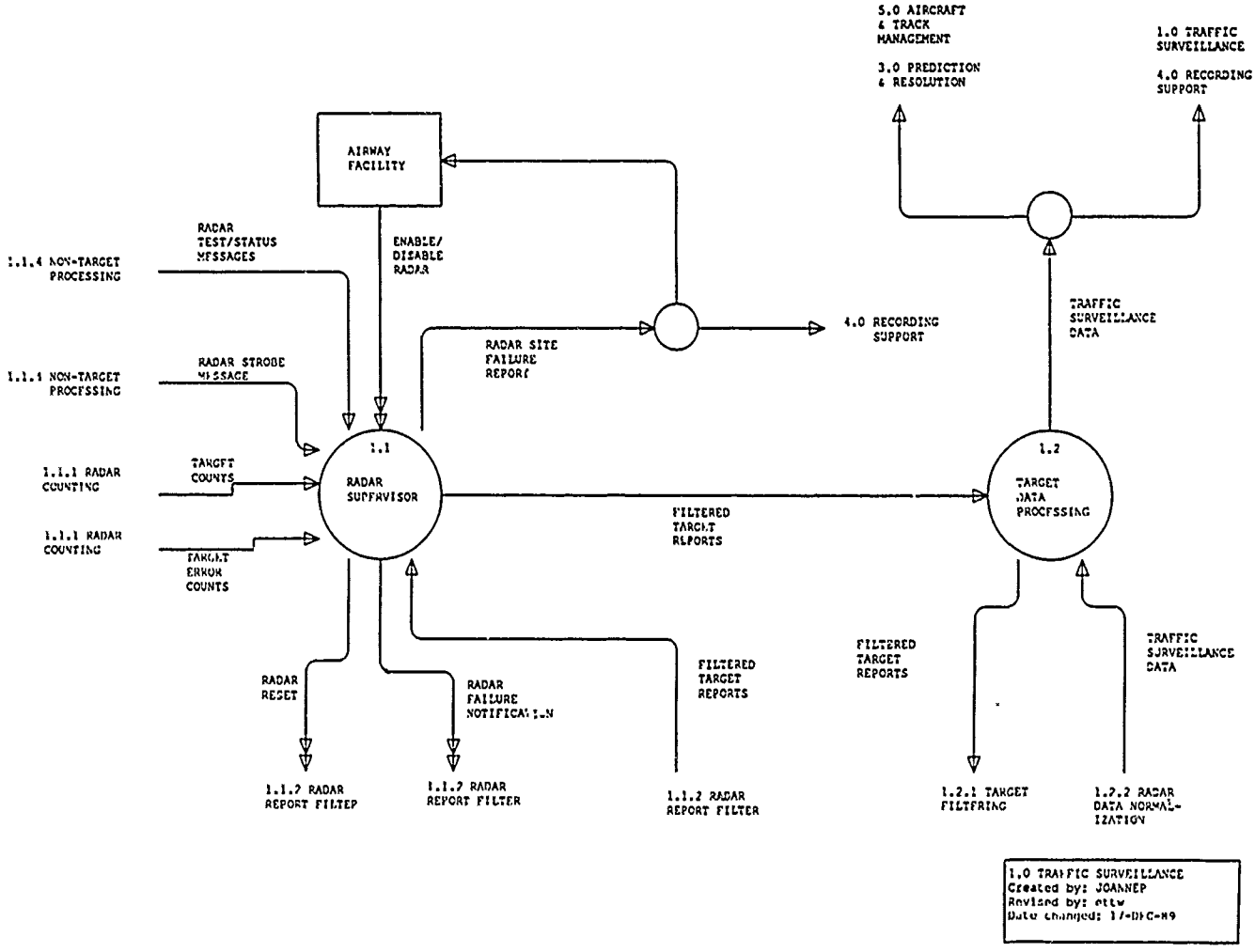


Figure 13. 1.0 TRAFFIC SURVEILLANCE. This figure illustrates TRAFFIC SURVEILLANCE and its children objects 1.1 RADAR SUPERVISOR and 1.2 TARGET DATA PROCESSING.

1.1 Radar Supervisor

1.1 Description

The 1.1 RADAR SUPERVISOR object shall examine radar data from Mode S Radar Beacon Sites (secondary radar sites) and primary radar sites to determine radar failures. Any radar failures found shall be logged for review by Airway Facilities to take the appropriate corrective action. Airway Facilities will assume all responsibilities for equipment maintenance and repair. Further, upon error discovery, the RADAR SUPERVISOR shall declare the suspect radar invalid and shall issue instructions for reports from the invalid radar to be filtered out. Counts provided from the RADAR DATA COUNTING object are analyzed to determine if there are excessive or missing types of targets and to declare a site with missing or excessive targets or errors as a failed radar site. Finally, the RADAR SUPERVISOR shall provide a message routing function taking the basic filtered target reports received and forward them to TARGET DATA PROCESSING for further processing.

1.1 Inputs

- RADAR_TEST_STATUS_MESSAGES - A test or status message received from a radar site indicating equipment status
- RADAR_STROBE_MESSAGE - A message indicating that jamming of primary or secondary radar site data is in effect, or is no longer in effect
- TARGET_COUNTS - A count of the radar returns for a given radar site
- TARGET_ERROR_COUNTS - A count of the errors in the radar returns for a given radar site. The count is used to check the status of the site's radars
- FILTERED_TARGET_REPORTS - Target Reports that have been filtered to only have nonstationary targets from good sites and nonrestricted coverage areas
- ENABLE_DISABLE_RADAR - A discrete message sent indicating that a selected radar is to be enabled or disabled. The message is addressed (via RADAR_ID) to a particular site radar. An enable radar message is sent after a radar has been repaired. A disable radar message is sent upon error discovery and validation.

1.1 Outputs

- RADAR_RESET - Notification of a reset of a primary or secondary radar site
- RADAR_FAILURE_NOTIFICATION - Notification of the failure of a primary or secondary radar site
- FILTERED_TARGET_REPORTS - Target Reports that have been filtered to only have nonstationary targets from good sites and nonrestricted coverage areas
- RADAR_SITE_FAILURE_REPORT - Report indicating that a radar site has failed. Airway Facilities receives this data, and makes the appropriate action determination

1.2 Target Data Processing

1.2 Description

TARGET DATA PROCESSING object shall filter out all FILTERED_TARGET_REPORTS that are out of the boundaries for a given area of airspace, and route the remaining FILTERED_TARGET_REPORTS to children objects for further processing. TARGET DATA PROCESSING shall normalize data collected from multiple radars to provide consistent information about a given target.

1.2 Inputs

- TRAFFIC_SURVELLANCE_DATA - Air Traffic Radar surveillance data that has been normalized for further processing by other ATC subsystems and for use in assembling integrated view data for presentation. Data may contain data overlapping other sector's airspace boundaries that require elimination for sector processing.
- FILTERED_TARGET_REPORTS - Target Reports that have been filtered to have only nonstationary targets from good sites and nonrestricted coverage areas.

1.2 Outputs

- TRAFFIC_SURVELLANCE_DATA - Air Traffic radar surveillance data that has been normalized for further processing by other ATC subsystems and for use in assembling integrated view data for presentation.
- FILTERED_TARGET_REPORTS - Target Reports that have been filtered to only have nonstationary targets from good sites and nonrestricted coverage areas; Target data outside of the sector's airspace boundaries have been filtered out.

1.1 Radar Supervisor Discussion

The 1.1 RADAR SUPERVISOR object shall examine radar data from Mode S Radar Beacon Sites (secondary radar sites) and primary radar sites to determine radar failures. Any radar failures found shall be logged for review by Airway Facilities to take the appropriate corrective action. Airway Facilities will assume all responsibilities for equipment maintenance and repair. Further, upon error discovery, the RADAR SUPERVISOR shall declare the suspect radar invalid and shall issue instructions for reports from the invalid radar to be filtered out. Counts provided from the RADAR DATA COUNTING object are analyzed to determine if there are excessive or missing types of targets and to declare a site with missing or excessive targets or errors as a failed radar site. Finally, the RADAR SUPERVISOR shall provide a message routing function taking the basic filtered target reports received and forward them to TARGET DATA PROCESSING for further processing. 1.1 RADAR SUPERVISOR is illustrated in Figure 14 on page 35. The state transition diagram illustrating the behavior of RADAR SUPERVISOR given radar status is illustrated in Figure 15 on page 36.

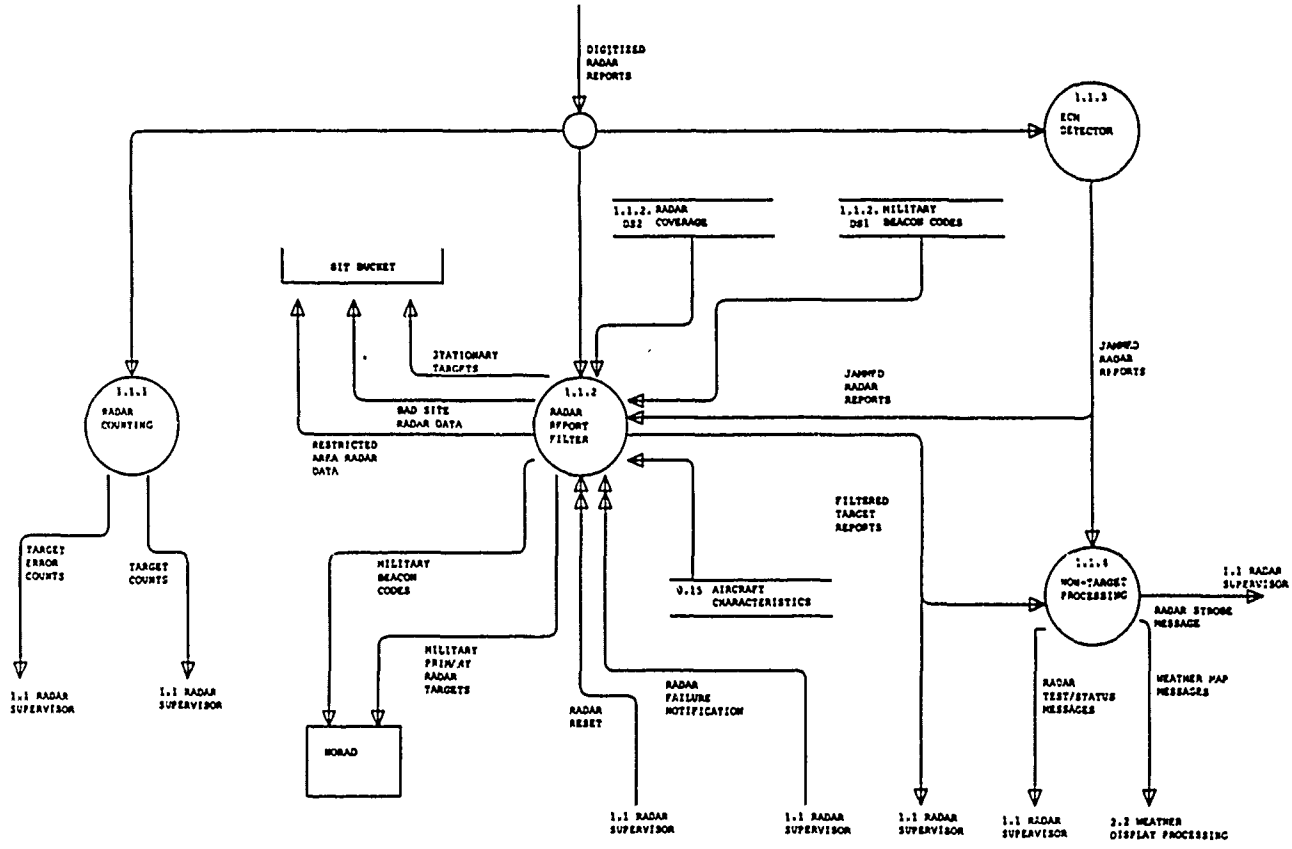


Figure 14. 1.1 RADAR SUPERVISOR. This figure illustrates RADAR SUPERVISOR and its children objects, 1.1.1 RADAR COUNTING, 1.1.2 RADAR REPORT FILTER, 1.1.3 ECM DETECTOR, 1.1.4 NON-TARGET DATA PROCESSING.

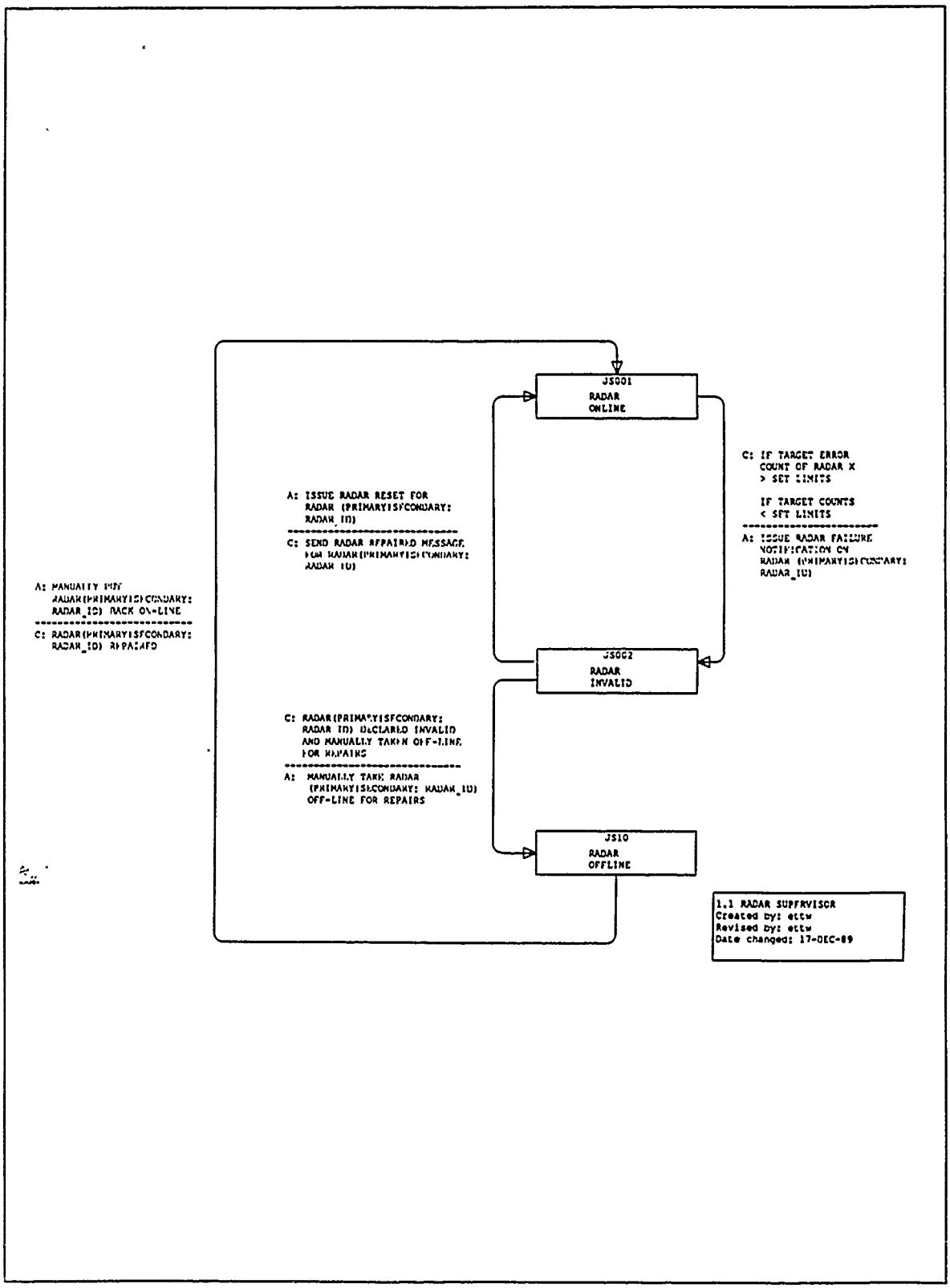


Figure 15. 1.1 RADAR SUPERVISOR BEHAVIOR. This figure illustrates the state transition diagram for changing between three states, namely: RADAR ONLINE, RADAR INVALID, and RADAR OFFLINE.

1.1.1 Radar Data Counting

1.1.1 Description

The RADAR DATA COUNTING object shall examine radar counts to ascertain excesses or failures in radar data received from reporting radar sites. Counts shall be maintained for number of targets and target errors received from each radar site.

1.1.1 Inputs

- DIGITIZED_RADAR_REPORTS - Digitized radar target reports.

1.1.1 Outputs

- TARGET_COUNTS - A count of the radar returns for a given radar site;
- TARGET_ERROR_COUNTS - A count of the errors in the radar returns for a given radar site. The count is used to check the status of the sites.

1.1.2 Radar Report Filter

1.1.2 Description

The RADAR REPORT FILTER object shall reduce the number of radar returns to be processed. Radar returns shall be discarded if they are received from failed radar sites. Radar returns may also be discarded where aircraft are in areas where aircraft target detection may be restricted or inhibited, or if the mode C altitude return is determined to be unreasonable. The type of target is also identified so that targets such as military targets can be forwarded directly to NORAD for processing. Further, based on military beacon codes and military area coverage requirements, reports can be filtered to mask out military flights and airspace, as required.

Masking is the process of filtering radar data by area, and is used to reduce the number of radar returns to be processed by the remaining subprograms. Areas with more than double radar coverage are considered for masking, which is applied selectively on a Rho,Theta basis for each radar. The mask for each radar is controlled by the adaptation parameters which is used to compensate for radar failures.

Mode C altitude shall be checked for reasonableness and unreasonable altitudes shall be discarded. The mode C altitude is compared with adapted aircraft characteristics and unreasonable altitudes discarded.

The state transition diagram describing the behavior of the RADAR REPORT FILTER object for transitioning between radar validity states is depicted in Figure 16 on page 39.

1.1.2 Inputs

- DIGITIZED_RADAR_REPORTS - Digitized radar target reports;
- RADAR_RESET - Notification of a reset of a primary or secondary radar site;
- RADAR_FAILURE_NOTIFICATION - Notification of the failure of a primary or secondary radar site;
- JAMMED_RADAR_REPORTS - Radar reports that are declared invalid due to a jamming condition;
- RADAR_COVERAGE (DATA STORE) - to provide RADAR REPORT FILTER with radar coverage area;

- MILITARY_BEACON_CODES (DATA STORE) - to provide RADAR REPORT FILTER with the ability to identify military beacon codes;
- AIRCRAFT_CHARACTERISTICS (DATA STORE) - to provide RADAR REPORT FILTER with the ability to determine whether or not a return is an aircraft.

1.1.2 Outputs

- FILTERED_TARGET_REPORTS - Target Reports that have been filtered to only have nonstationary targets from good sites and nonrestricted areas;
- MILITARY_PRIMARY_RADAR_TARGETS - Primary radar returns that are for military aircraft;
- MILITARY_BEACON_CODES - Beacon codes from military aircraft;
- BAD_SITE_RADAR_DATA - Radar data that is received from a radar site that has a failure status. The data is discarded (shown as going into the BIT BUCKET on Figure 14 on page 35.
- STATIONARY_TARGETS - Stationary radar targets that are discarded as non-targets (shown as going into the BIT BUCKET on Figure 14 on page 35;
- RESTRICTED_AREA_RADAR_DATA - Radar returns from a restricted area that are discarded (shown as going into the BIT BUCKET on Figure 14 on page 35.

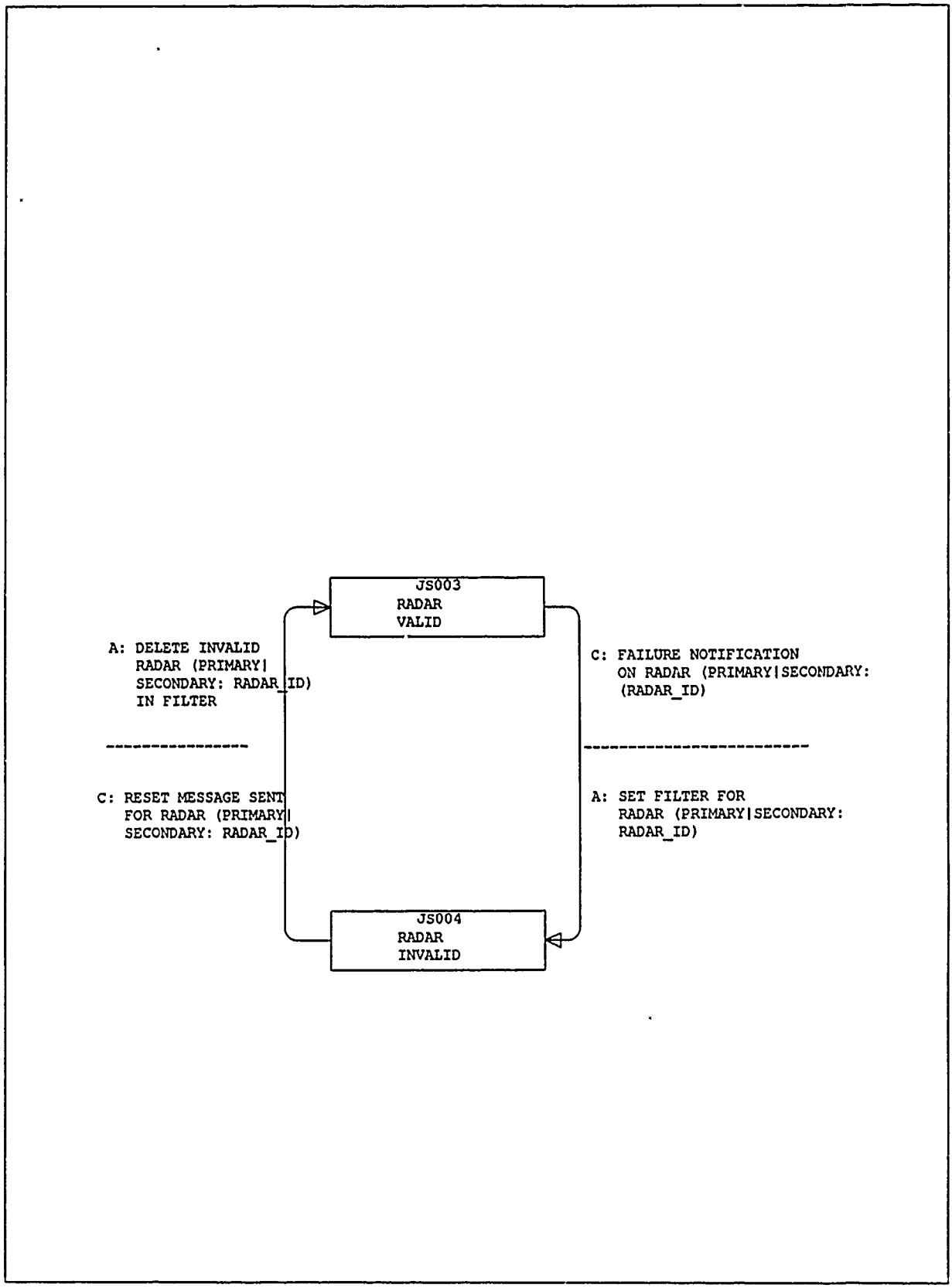


Figure 16. 1.1.2 RADAR REPORT FILTER. This figure illustrates the state transition diagram for changing between two states, namely: RADAR VALID and RADAR INVALID.

1.1.3 ECM Detection

1.1.3 Description

The ECM DETECTOR object shall identify radar returns that have originated in an area which is being jammed by electromagnetic counter measures.

1.1.3 Inputs

- DIGITIZED_RADAR_REPORTS - Digitized radar target reports.

1.1.3 Outputs

- JAMMED_RADAR_REPORTS - Radar reports that are declared invalid due to a jamming condition.

1.1.4 Non-Target Processing

1.1.4 Description

Non-target as well as target messages are received from the primary and secondary radar sites. Non-Target Processing monitors the test and status messages, generates a strobe message, and forwards the map messages to weather surveillance processing.

A status message indicates one or more of several radar site problems. The radar sites send fixed search and fixed beacon test messages that are examined by Non-Target Processing to evaluate equipment and site performance. The messages are compared with correct values in the adaptation and should one of the parameters not be within acceptable tolerance, a test message error is output.

If a jamming report is issued due to electromagnetic counter measures, a strobe message is issued. The strobe information notifies the computer that certain azimuth wedges have been blanked out because they were completely filled by some interfering signal such as excess fruit or interference from some nearby radar.

1.1.4 Inputs

- FILTERED_TARGET_REPORTS - Target Reports that have been filtered to only have nonstationary targets from good sites and nonrestricted areas;
- JAMMED_RADAR_REPORTS - Radar reports that are declared invalid due to a jamming condition.

1.1.4 Outputs

- RADAR_STROBE_MESSAGE - A message indicating that jamming of primary or secondary radar site data is in effect or is no longer in effect;
- RADAR_TEST_STATUS_MESSAGES - A test or status message received from a radar site indicating equipment status;
- WEATHER_MAP_MESSAGES - Weather radar messages that have been sent with the traffic radar.

1.1.1.1 Digitize Reports Discussion

Target positions are determined from the range and azimuth from the radar site, and are provided on all detected targets by search and beacon radar. The resulting analog signals are digitized. Radar reports are provided by both the primary and secondary radar. 1.1.1.1 DIGITIZE REPORTS is shown in Figure 17 on page 42

Primary Radar The search radar ground station detects aircraft, ground clutter, and weather clutter resulting from reflection of signals transmitted from the ground station.

Secondary Radar

Secondary radars (beacon radar) provide discrete identity and altitude reporting. A beacon radar ground station detects beacon codes from aircraft equipped with transponders which are activated upon receipt of interrogation signal. The station also receives pressure altitude data from all aircraft equipped with transponders capable of so responding to Mode C interrogations.

Mode A is used for detection and identity. Mode C is used for requesting altitude information.

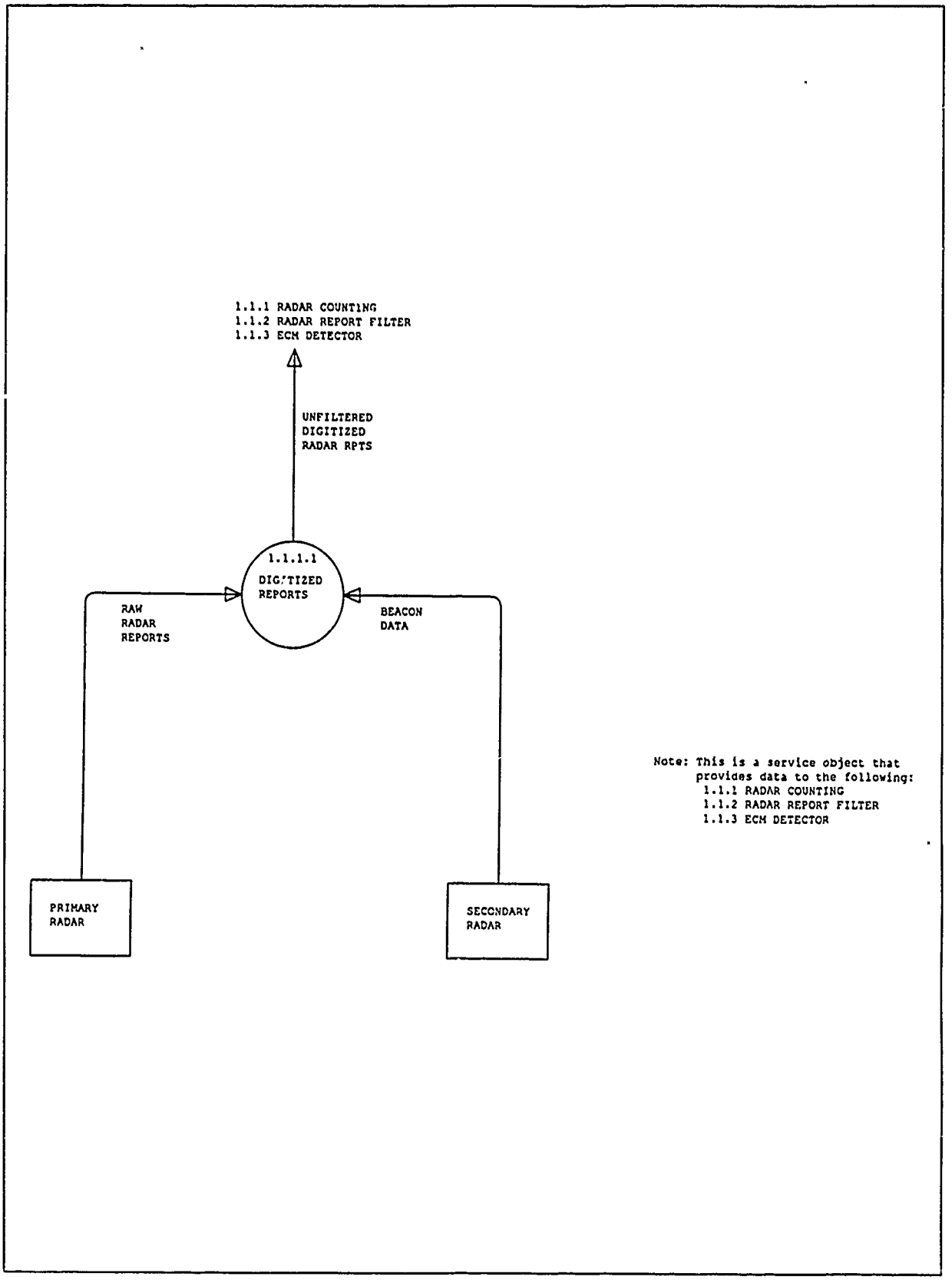


Figure 17. 1 1.1.1 DIGITIZE REPORTS. This figure illustrates DIGITIZE REPORTS receiving raw reports from the PRIMARY RADAR and the SECONDARY RADAR. DIGITIZE REPORTS is an IOM primitive.

1.1.1.1 Inputs

- RAW_RADAR_REPORTS - Unprocessed radar returns input from the primary radar;
- BEACON_DATA - Unprocessed beacon target returns from the secondary radar.

1.1.1.1 Outputs

- UNFILTERED_DIGITIZED_REPORTS - Digitized radar reports that have come from good radar sites, failed radar sites, and jammed radar sites.

1.2.1 Target Data Processing Discussion

TARGET DATA PROCESSING object shall filter out all FILTERED_TARGET_REPORTS that are out of the boundaries for a given area of airspace, and route the remaining FILTERED_TARGET_REPORTS to children objects for further processing. TARGET DATA PROCESSING shall normalize data collected from multiple radars to provide consistent information about a given target.

TARGET DATA PROCESSING is illustrated in Figure 18 on page 45.

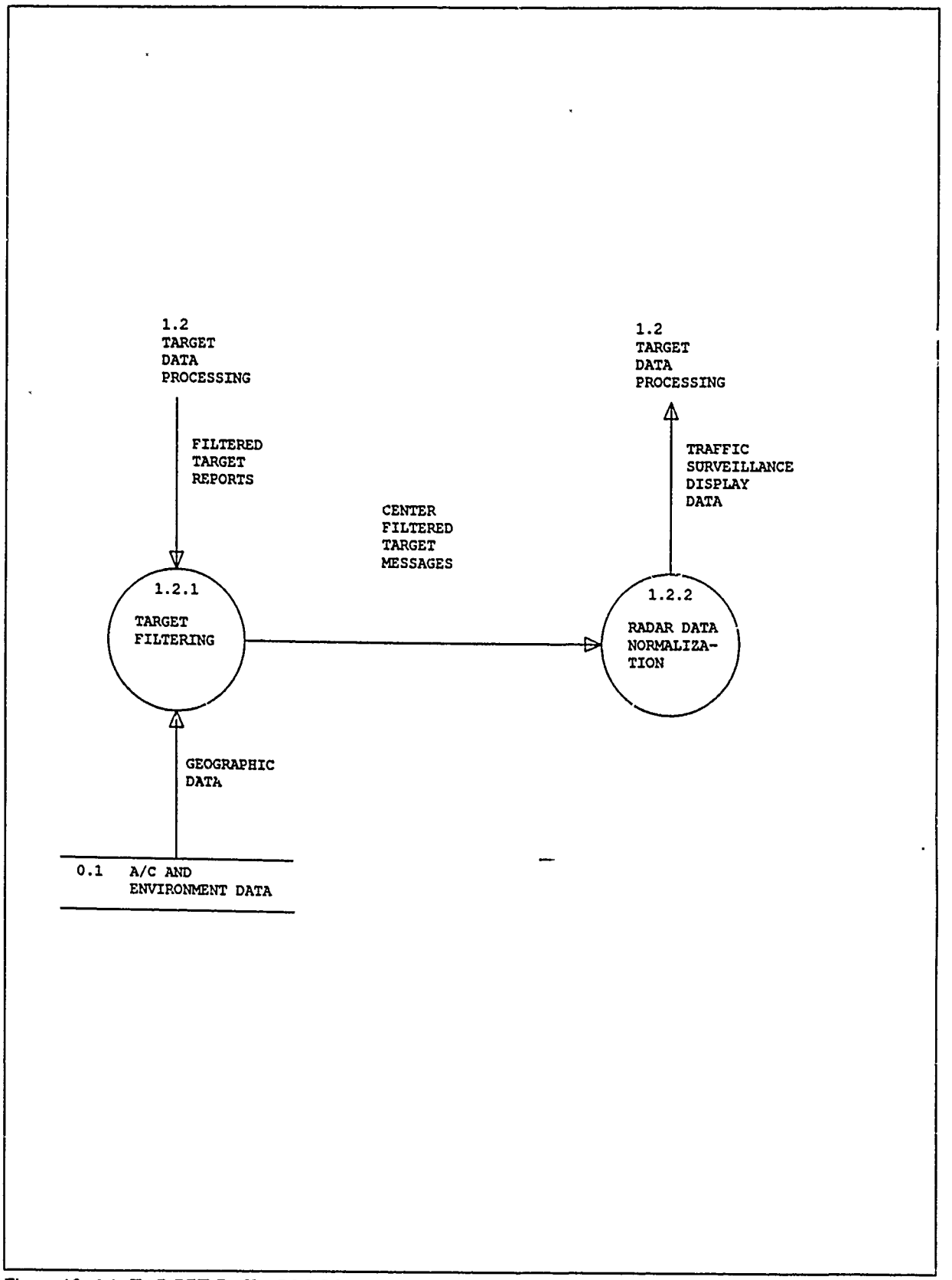


Figure 18. 1.2 TARGET DATA PROCESSING. This figure illustrates TARGET DATA PROCESSING and its two IOM primitives, TARGET FILTERING and RADAR DATA NORMALIZATION.

1.2.1 Target Filtering

1.2.1 Description

The TARGET FILTERING object shall accept digitized radar data and discard received target reports from further processing when these reports are within adapted areas. The adapted areas shall change automatically when facility backup is invoked and shall be dependent on which radar is being backed up.

The filter shall be reconfigurable to account for failed radar sites. The reconfiguration shall be initiated by a manual input from the monitor and control console or automatically when a radar site is declared to have failed by the radar data counting function.

Two types of filtering take place - fixed mapping which is used to eliminate coverage in geographic areas that are not needed and filtering that is used in areas of multiple surveillance site coverage so that the situation display presents only a single target symbol per aircraft.

Surveillance reports shall be filtered by volumes of airspace. A preferred radar shall be adapted for each airspace volume. If a surveillance report on a aircraft is missing from the preferred radar, then a report from an alternate radar shall be displayed as determined by adaptation.

1.2.1 Inputs

- FILTERED_TARGET_REPORTS - Target Reports that have been filtered to only have nonstationary targets from good sites and nonrestricted areas;
- GEOGRAPHIC_DATA - Geographic data pertaining to center boundary definitions used for filtering out reports outside a coverage area.

1.2.1 Outputs

- CENTER_FILTERED_TARGET_MSGS - Target messages that pertain to a given center. All data not pertinent to the center have been discarded.

1.2.2 Radar Data Normalization

1.2.2 Description

RADAR DATA NORMALIZATION involves the following tasks:

- Collimation Correction
- Coordinate Conversion
- Altitude Tracking
- Registration Correction

Collimation Correction

Collimation is the process of detecting the misalignment between the primary and secondary antennas. A target's Rho/Theta data for search radar is compared with that of beacon radar to detect collimation errors. Collimation error corrections are recommended to the system engineer.

Coordinate Conversion

Coordinate conversion transforms data from polar (Rho/Theta) coordinates to system coordinates. Coordinate conversion of radar data is needed for displays which require x,y coordinates rather than Rho,Theta. If

more than one radar is supplying data to a display or to an automatic tracking program, the data could be converted to simple x,y with a common reference point. Because of the earth's curvature and the fact that North azimuth lines from two radars not on the same longitude are not parallel, the display could show two returns, and the tracking program could have difficulty in maintaining a single track. The data from a single track must have the same system coordinates even though the target is reported from different radars. The data is converted to a common system plane. The most common method of converting radar position data to a system plane is to use a stereographic projection.

Altitude Tracking

Altitude tracking shall be performed on paired tracks using mode C altitudes which conform to operational requirements for mode C reasonableness and conformance criteria.

Registration Correction Registration is used to check the relative alignment between radars and calculate corrections to the input data. These corrections can then be applied automatically on a continuous basis, or by the system engineer.

This analysis involves the comparison of range and azimuth data from different radar sites on the same target in the stereographic plane to detect errors for a particular site. The registration error message is sent to the system engineer for a site, who causes correction factors to be applied to the radar data (Rho/Theta) from a given site.

1.2.2 Inputs

- CENTER_FILTERED_TARGET_MSGS - Target messages that pertain to a given center. All data not pertinent to the center have been discarded.

1.2.2 Outputs

- TRAFFIC_SURVEILLANCE_DISPLAY_DATA - Normalized traffic surveillance data is sent to 1.2 TARGET DATA PROCESSING for processing and routing.

Section Supplement

This section provides summary reports on data employed and derived by the functional object 1.0 Traffic Surveillance.

"All Data Flows" Report

The following report, generated from the Excelerator database, identifies all data flows for the Traffic Surveillance object.

Name	Alternate Name	Short Descrip.	Last Modify Date
J0101	BAD SITE RADAR DATA	Radar data that is received from a radar site that has a failure status. The data is discarded.	891215
J0073	BEACON DATA	Unprocessed beacon target returns from the secondary radar.	891213
J0104	CENTER FILTERED TARGET MSGS	Target messages that pertain to a given center. All data not pertinent to the center have been discarded.	891215
J0059	DIGITIZED RADAR REPORTS	Digitized radar targets.	891217
J0092	ENABLE DISABLE RADAR	A message indicating that a radar site has been enabled or disabled. The message includes the radar id.	891215
J0071	FILTERED TARGET REPORTS	Target Reports that have been filtered to only have nonstationary targets from good sites and nonrestricted area	891217
J0106	GEOGRAPHIC DATA	Geographic data pertaining to center boundary definitions.	891214
J0095	JAMMED RADAR REPORTS	Radar reports that are declared invalid due to a jamming condition.	891214
J0100	MILITARY BEACON CODES	Beacon codes for military aircraft.	891215
J0079	MILITARY PRIMARY RADAR TARGETS	Primary radar returns that are for military aircraft.	891215
J0058	PROCESSED RADAR REPORTS	Radar targets that have been filtered, converted, and corrected.	891206
J0090	RADAR FAILURE NOTIFICATION	Notification of the failure of a primary or secondary radar site.	891215
J0098	RADAR RESET	Notification of a reset of a primary or secondary radar site.	891215
J0199	RADAR SITE FAILURE/RESET REPORT	Radar action reports sent to RECORDING SUPPORT for event logging and further action. Rpts sent upon racar state chg.	900425
J0079	RADAR SITE FAILURE REPORT	Report indicating that a radar site has failed. Airway Facilities receives this data.	891216
J0113	RADAR SITE FAILURE RESET REPORT	A report of a failed radar site or a reset radar site to be logged.	891213
J0075	RADAR STROBE MESSAGE	A message indicating that jamming of primary or secondary radar site data is in effect or is no longer in effect.	891214
J0107	RADAR TEST STATUS MESSAGES	A test or status message received from a radar site indicating equipment status.	891216
J0078	RAW RADAR REPORTS	Unprocessed radar returns input from the primary radar.	891216
J0201	RAW WEATHER RADAR REPORTS	Unprocessed weather radar returns input from weather racar.	891216

Name	Alternate Name	Short Descrip.	Last Modify Date
J0103	RESTRICTED AREA RADAR DATA	Radar returns from a restricted area that are discarded.	891215
J0102	STATIONARY TARGETS	Stationary radar targets that are discarded as non-targets.	891215
J0051	TARGET COUNTS	A count of the radar returns for a radar site.	891218
J0052	TARGET ERROR COUNTS	A count of the errors in the radar returns for a radar site. The count is used to check the status of the sites.	891218
J0198	TRACK HISTORY UPDATES	Aircraft target track messages are stored in the TRACK HISTORY database for reference by other ATC subsystems	900425
J0077	TRAFFIC INFORMATION	An integrated view of the air traffic presented to the controller.	891206
J0116	TRAFFIC SURVELLANCE DATA	Radar surveillance data of air traffic that has been normalized for further processing and use by other ATC subsy	900425
J0110	TRAFFIC SURV DISPLAY DATA	Normalized traffic surveillance data.	891216
J0097	UNFILTERED BEACON CODES	Beacon codes that have come from good secondary radar sites, failed sec. radar sites, and jammed sec. radar sites.	891213
J0094	UNFILTERED DIGITIZED REPORTS	Digitized radar reports that have come from good radar sites, failed radar sites, and jammed radar sites.	891215
J0112	WEATHER DATA	Weather information originating from the Real Time Weather Processor	891216
J0108	WEATHER MAP MESSAGES	Weather radar messages that have been sent with the traffic radar.	891217
J0087	WEATHER SURV DISPLAY DATA	An integrated view of weather surveillance info converted to polygons for display.	891217
J0111	WEATHER SURV INFO	An integrated weather surveillance view.	891217

"All Data Stores" Report

The following report, generated from the Excelerator database, identifies all data stores for the Traffic Surveillance object. 1.0 Traffic Surveillance also employs/derives/updates the following globally defined data store, defined in Appendix A of this document:

- TRACK_HISTORY.

Name	Alternate Name	Contains Data St	Last Modify Date
1.1.2.DS1	MILITARY BEACON CODES		900426
1.1.2.DS2	RADAR COVERAGE		900426

Name	Alternate Name	Long Description
1.1.2.	MILITARY BEACON CODES	The MILITARY BEACON CODES database provides the 1.1.2 RADAR REPORT FILTER with military beacon code ids. This enables 1.1.2 RADAR REPORT FILTER to mask target reports with certain military beacon codes, and to add information to target reports.
1.1.2.	RADAR COVERAGE	The RADAR COVERAGE database provides the 1.1.2 RADAR REPORT FILTER with radar coverage information, allowing it to filter out reports, that are outside of the area the radar is responsible to report.

2.0 Weather Surveillance

Introduction The Weather Surveillance object is responsible for providing weather surveillance information to Area Control for final processing to display an integrated view of air traffic and weather surveillance information to air traffic controllers.

The WEATHER SURVEILLANCE object will be introduced by four graphics, namely:

- The Weather Surveillance View From
- The Weather Surveillance Interfaces
- The Weather Surveillance Functional Object Tree
- Weather Surveillance.

2.0 Weather Surveillance "View From"

The DoD AAS Area Control view from 2.0 WEATHER SURVEILLANCE is illustrated by Figure 19 on page 51. The "view from" presents all of the major functional objects of the DoD AAS Area Control and their relationship to WEATHER SURVEILLANCE by the messages that are passed to and from it.

The WEATHER SURVEILLANCE object provides weather surveillance information to Prediction and Resolution, Flight Plan Operations Support, and Recording Support. It provides Weather Surveillance Display Data to Area Control for further processing and controller presentation. FInally, Radar Site Failure/Reset Reports are sent to Recording Support for logging.

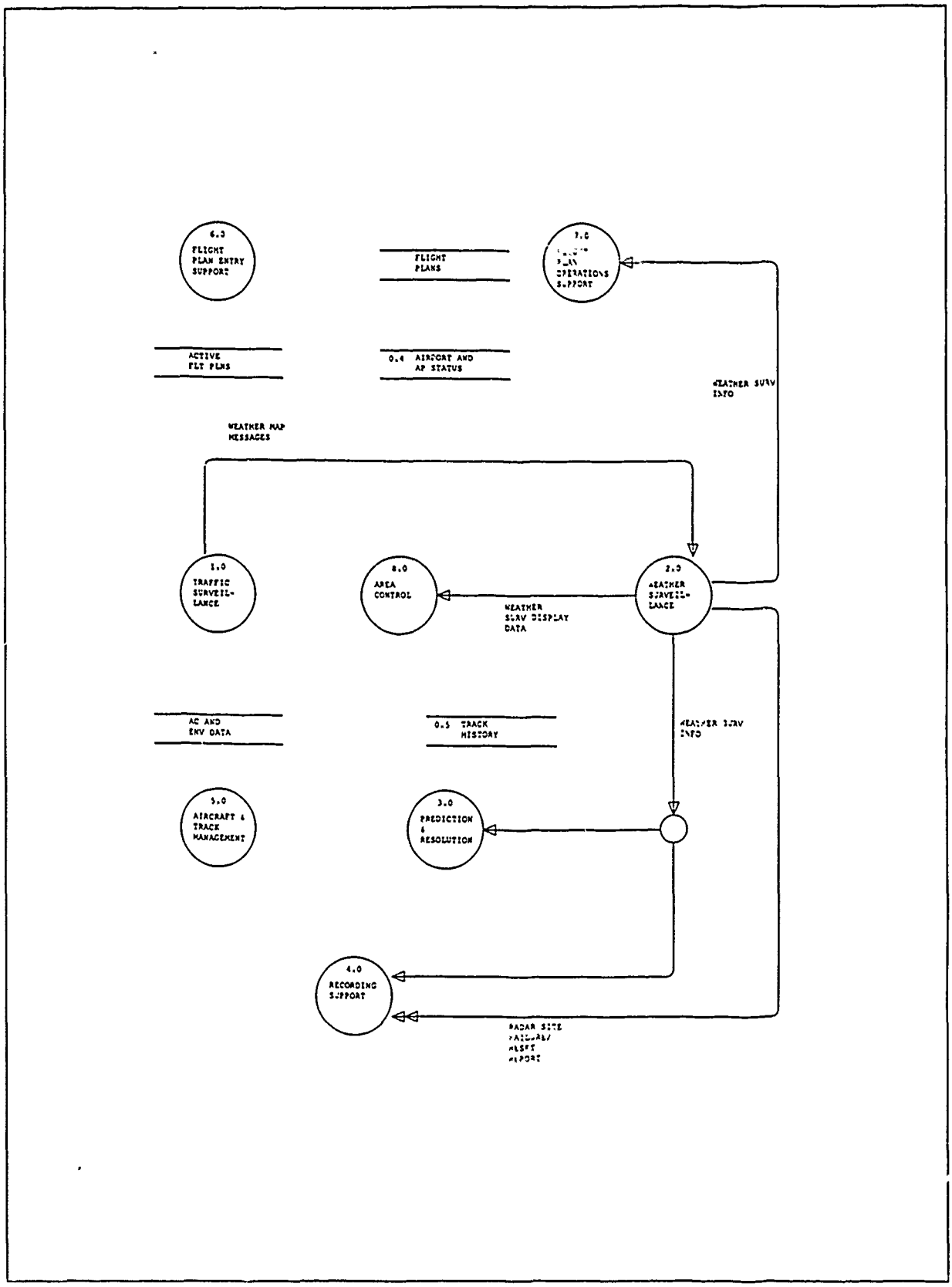


Figure 19. DoD AAS Area Control View from WEATHER SURVEILLANCE. This figure illustrates the view of DoD AAS Area Control with respect to WEATHER SURVEILLANCE. This diagram also presents all of the major functional objects of the DoD AAS Area Control IOM and the message "pipes" that connect them to WEATHER SURVEILLANCE.

2.0 Weather Surveillance Interfaces

The WEATHER SURVEILLANCE object provides weather surveillance information to Prediction and Resolution, Flight Plan Operations Support, and Recording Support. It provides Weather Surveillance Display Data to Area Control for further processing and controller presentation. FInally, Radar Site Failure/Reset Reports are sent to Recording Support for logging. Weather data is provided from the Real-Time Weather Processor and the Weather surveillance radars. Weather front map messages are received from Traffic Surveillance radars to augment the Weather surveillance radars.

The interfaces to WEATHER SURVEILLANCE are illustrated on Figure 20 on page 53.

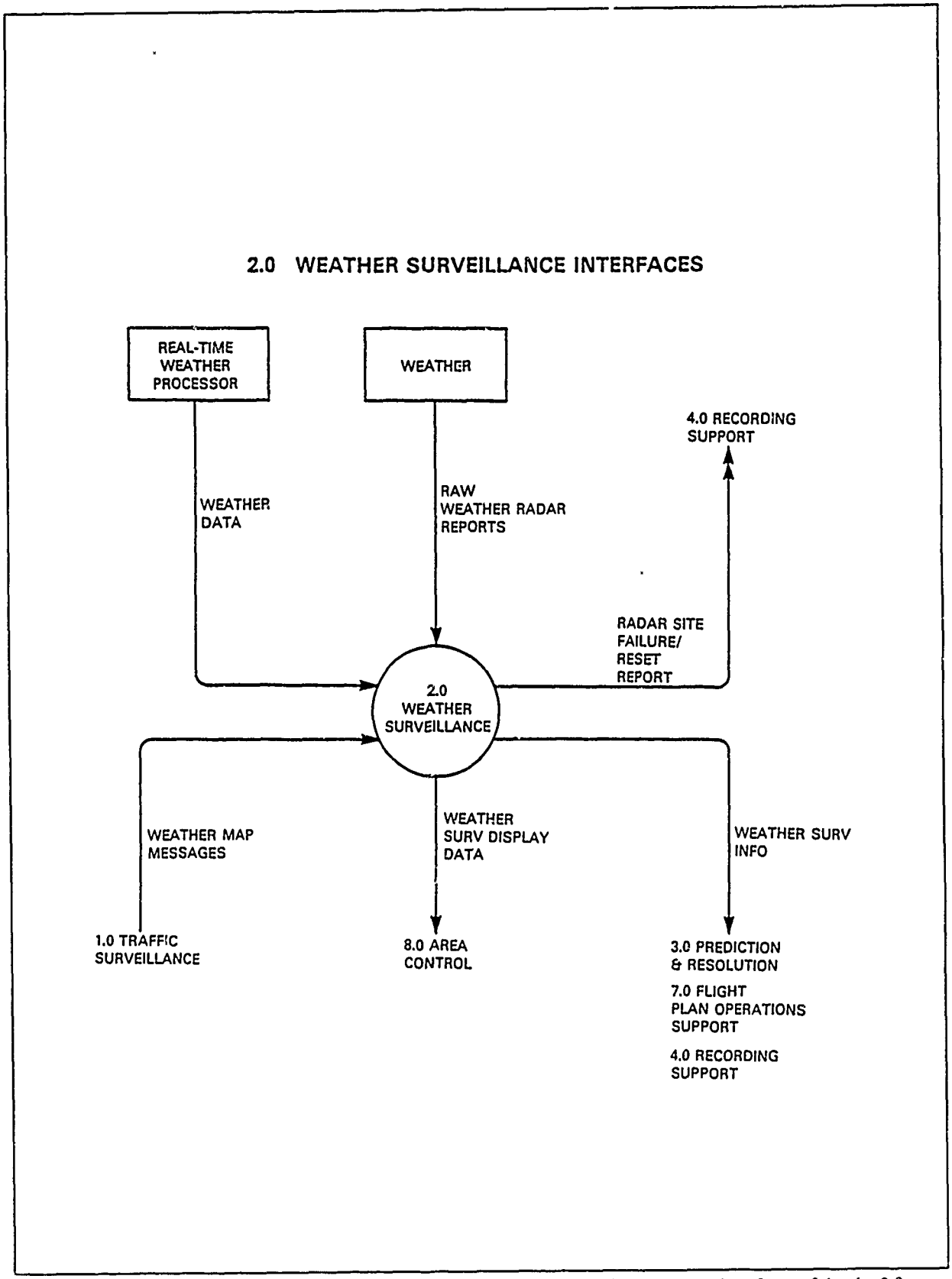


Figure 20. Interfaces for 2.0 WEATHER SURVEILLANCE. This figure illustrates the interfaces of the the 2.0 . WEATHER SURVEILLANCE functional object. This diagram shows the major inputs from other DoD AAS Area Control functional objects and external interfaces.

2.0 Weather Surveillance Inputs

- WEATHER_MAP_MESSAGES - Weather radar messages that have been provided from the traffic

2.0 Weather Surveillance Outputs

- WEATHER_SURV_DISPLAY_DATA - An integrated view of weather surveillance info converted to polygons for display;
- WEATHER_SURV_INFO - An integrated weather surveillance view.

2.0 Weather Surveillance Functional Object Tree

The functional object tree for 2.0 WEATHER SURVEILLANCE presents the object hierarchy of WEATHER SURVEILLANCE, as illustrated in Figure 12 on page 29 The functional object tree presents all of the graphics used to describe WEATHER SURVEILLANCE, as well as the message communication paths that show communication between peer objects, parent objects to child objects, and child to parent objects; It also identifies the communication paths between the decomposition levels.

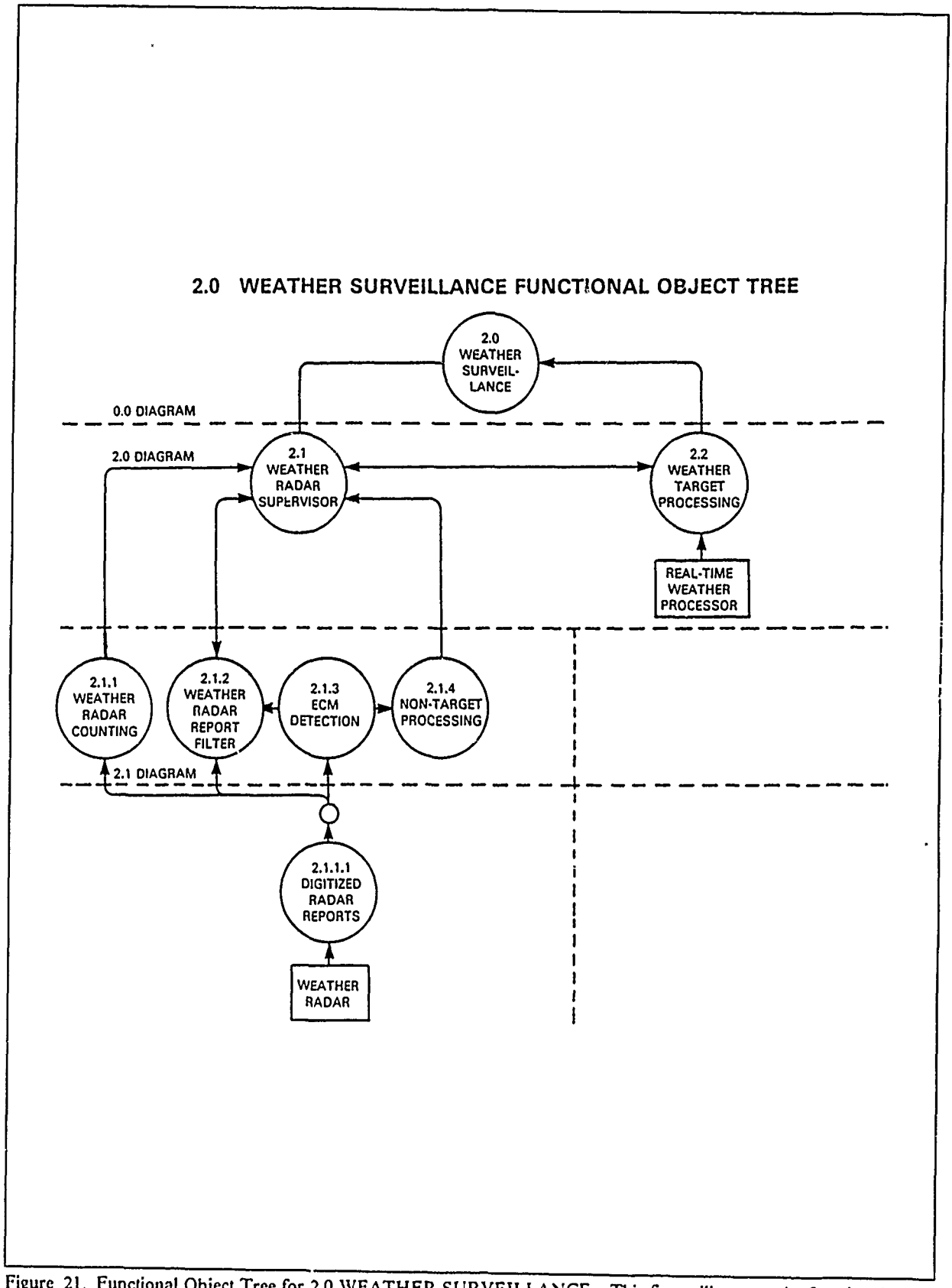


Figure 21. Functional Object Tree for 2.0 WEATHER SURVEILLANCE. This figure illustrates the functional object tree for the WEATHER SURVEILLANCE functional object. This tree shows the hierarchic relationship between the subordinate functional objects and shows message passing between peer objects, parent objects and child objects on different levels.

2.0 Weather Surveillance Discussion

The purpose of WEATHER SURVEILLANCE is to present to air traffic controllers a consistent view of weather conditions in a given sector of airspace. This view of weather conditions is provided from raw sensor data collected from both the primary traffic surveillance radars and single-purpose weather radars and processed to filter and present radar information about weather to air traffic controllers in the form of map overlays on the display console(s). Weather information is also provided to WEATHER SURVEILLANCE from the FAA realtime weather processor, located in in Kansas City, which collects weather information from all various weather data sources. WEATHER SURVEILLANCE is illustrated in Figure 22 on page 57.

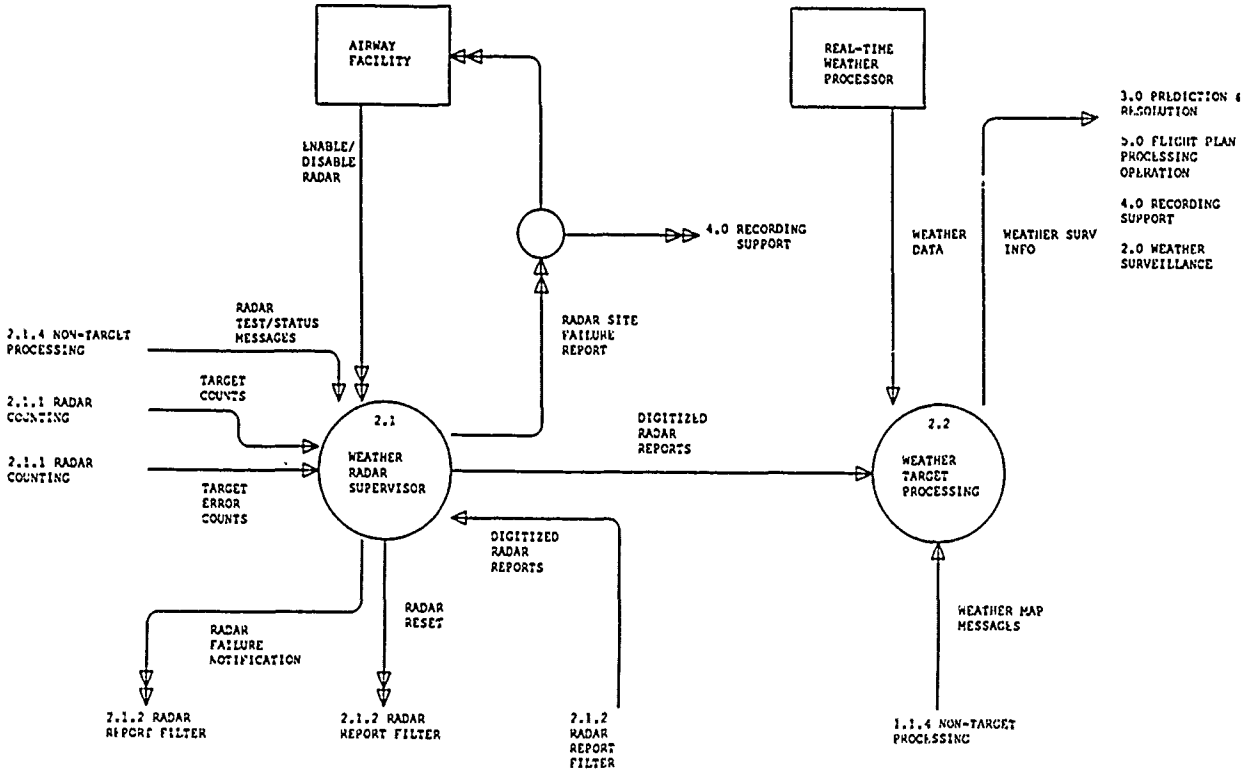


Figure 22. 2.0 WEATHER SURVEILLANCE. This figure illustrates WEATHER SURVEILLANCE and its children objects 2.1 WEATHER RADAR SUPERVISOR and 2.2 WEATHER DATA PROCESSING.

2.1 Weather Radar Supervisor

2.1 Description

The WEATHER RADAR SUPERVISOR object shall examine radar data from designated weather radar sites to determine radar failures. Any radar failures found sh[illegible]e logged for review by Airway Facilities to take the appropriate corrective action. Airway Facilities wi[illegible]sume all responsibilities for equipment maintenance and repair. Further, upon error discovery, the WEA[illegible]HER RADAR SUPERVISOR shall declare the suspect radar invalid and shall issue instructions for reports from the invalid radar to be filtered out. Counts provided from the RADAR DATA COUNTING object are analyzed to determine if there are excessive or missing types of targets and to declare a site with missing or excessive targets or errors as a failed radar site. Finally, the WEATHER RADAR SUPERVISOR shall provide a message routing function taking the basic filtered target reports received and forward them to TARGET DATA PROCESSING for further processing.

2.1 Inputs

- ENABLE_DISABLE_RADAR - A message indicating that a radar site has been enabled or disabled. The message includes the radar id;
- RADAR_TEST_STATUS_MESSAGES - A test or status message reveived from a radar site indicating equipment status;
- TARCET_COUNTS - A count of the radar returns for a radar site;
- TARGET_ERROR_COUNTS - A count of the errors in the radar returns for a given radar site. The count is used to check the status of the sites;
- DIGITIZED_RADAR_REPORTS - Digitized radar targets.

2.1 Outputs

- DIGITIZED_RADAR_REPORTS - Digitized radar targets forwarded to 2.2 WEATHER TARGET PROCESSING;
- RADAR_SITE_FAILURE_REPORT - Report indicating that a radar site has failed. Airway Facilities receives this data;
- RADAR_RESET - Notification of a reset of a primary or secondary radar site;
- RADAR_FAILURE_NOTIFICATION - Notification of the failure of a primary or secondary radar site;

2.2 Weather Target Processing

2.2 Description

The WEATHER TARGET PROCESSING object shall filter out all FILTERED_TARGET_REPORTS that are out of the boundaries for a given area of airspace, and route the remaining FILTERED_TARGET_REPORTS to children objects for further processing. WEATHER TARGET PROCESSING shall normalize data collected from multiple radars to provide consistent information about the weather.

2.2 Inputs

- DIGITIZED_RADAR_REPORTS - Digitized radar targets forwarded from 2.1 WEATHER RADAR SUPERVISOR;
- WEATHER_DATA - Weather information originating from the Real Time Weather Processor;
- WEATHER_MAP_MESSAGES - Weather radar messages that have been sent with the traffic radar.

2.2 Outputs

- WEATHER_SURV_INFO - An integrated weather surveillance view prepared for surveillance view integration processing.

2.1 Weather Radar Supervisor Discussion

The WEATHER RADAR SUPERVISOR object shall examine radar data from weather radar sites to determine radar failures. Any radar failures found shall be logged for review by Airway Facilities to take the appropriate corrective action. Airway Facilities will assume all responsibilities for equipment maintenance and repair. Further, upon error discovery, the WEATHER RADAR SUPERVISOR shall declare the suspect radar invalid and shall issue instructions for reports from the invalid radar to be filtered out. Counts provided from the RADAR DATA COUNTING object are analyzed to determine if there are excessive or missing types of targets and to declare a site with missing or excessive targets or errors as a failed radar site. Finally, the RADAR SUPERVISOR shall provide a message routing function taking the basic filtered target reports received and forward them to TARGET DATA PROCESSING for further processing. 2.1 WEATHER RADAR SUPERVISOR is illustrated in Figure 23 on page 61. The state transition diagram illustrating the behavior of RADAR SUPERVISOR given radar status is illustrated in Figure 24 on page 62.

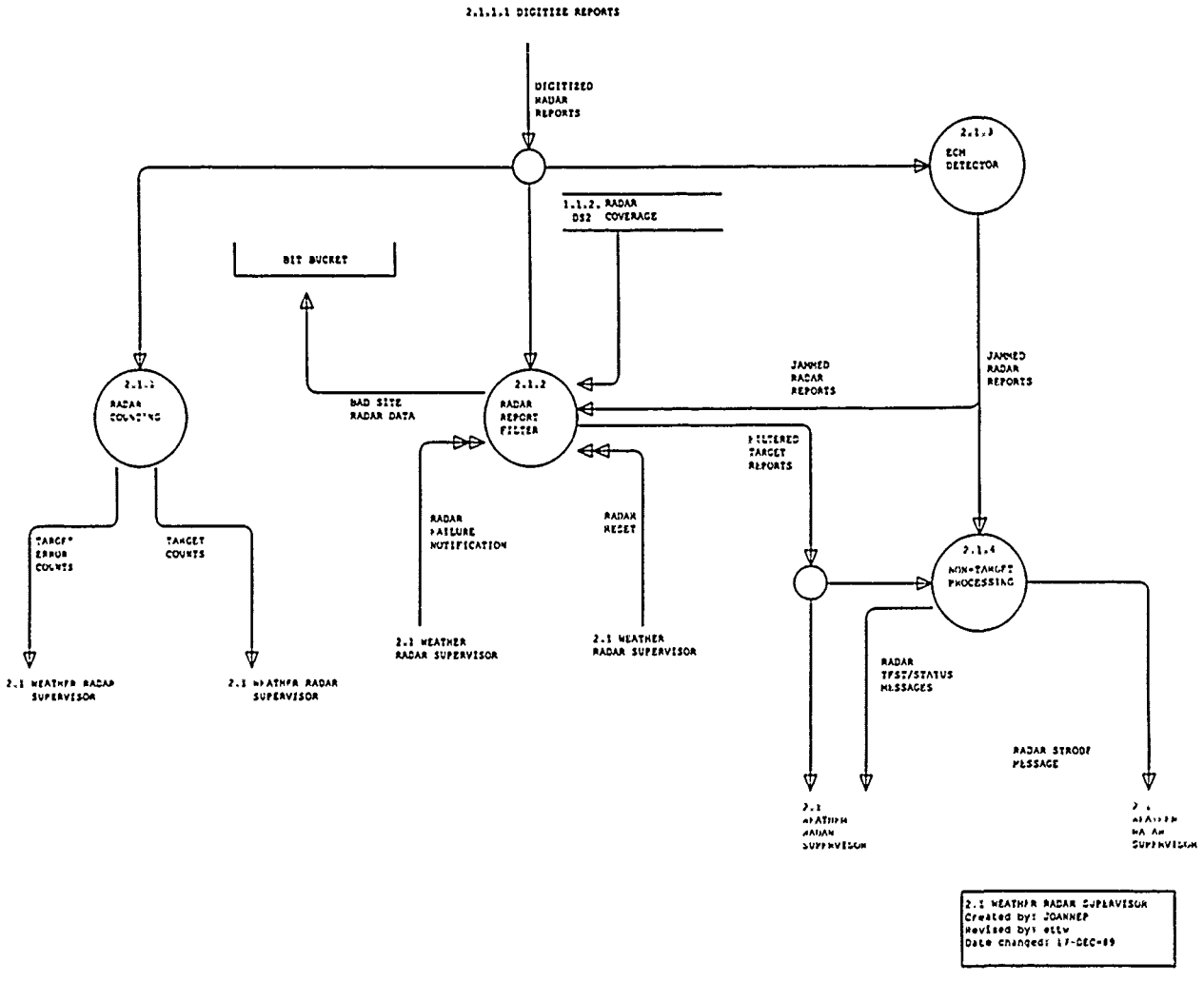


Figure 23. 2.1 WEATHER RADAR SUPERVISOR. This figure illustrates WEATHER RADAR SUPERVISOR and its children objects, 2.1.1 RADAR COUNTING, 2.1.2 RADAR REPORT FILTER, 2.1.3 ECM DETECTOR, 2.1.4 NON-TARGET DATA PROCESSING.

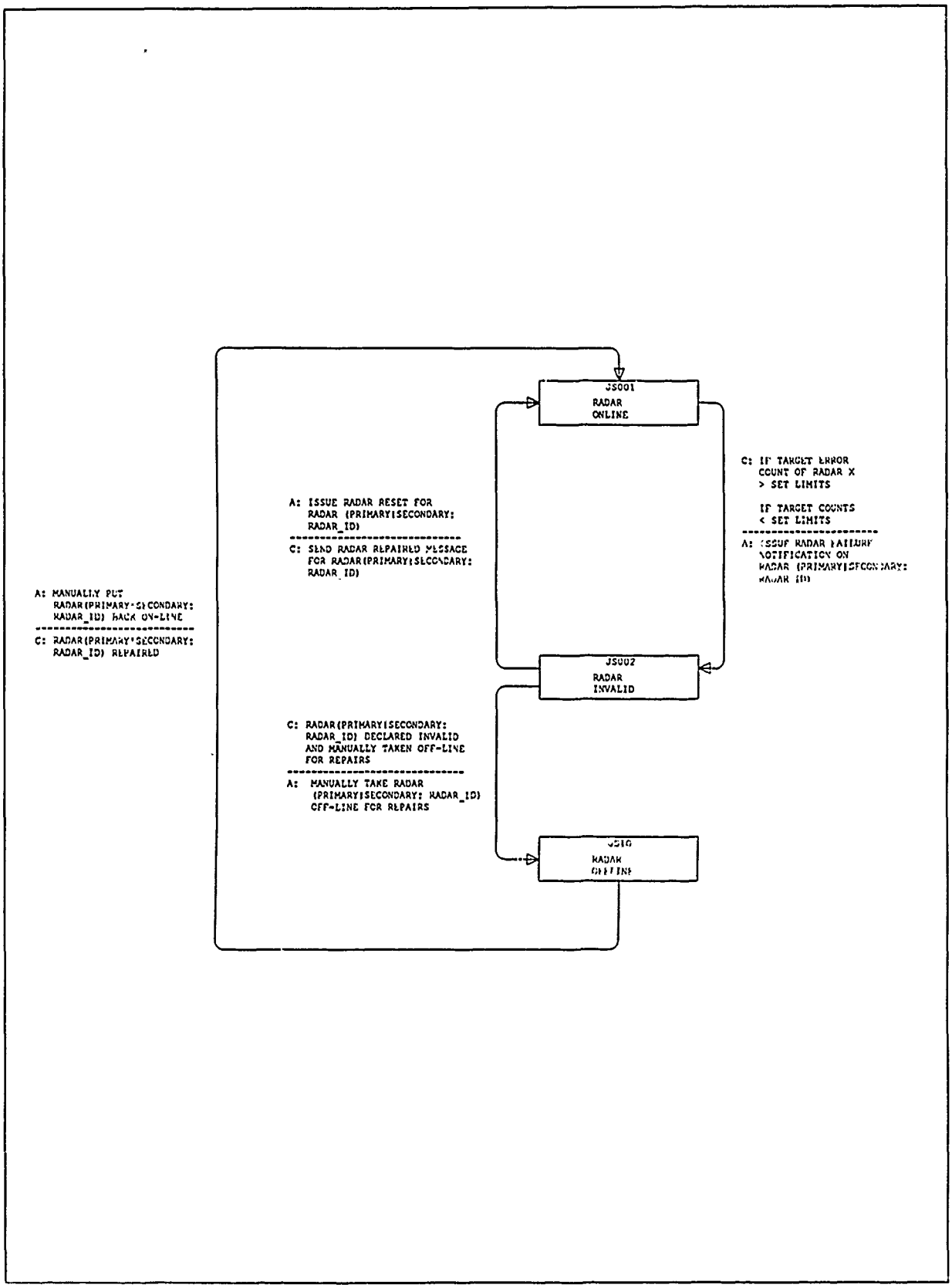


Figure 24. 2.1 WEATHER RADAR SUPERVISOR BEHAVIOR. This figure illustrates the state transition diagram for changing between three states, namely: RADAR ONLINE, RADAR INVALID, and RADAR OFFLINE.

2.1.1 Radar Counting

2.1.1 Description

The RADAR COUNTING object shall examine radar counts to ascertain excesses or failures in radar data received from reporting radar sites. Counts shall be maintained for number of targets and target errors received from each radar site.

2.1.1 Inputs

- DIGITIZED_RADAR_REPORTS - Digitized radar targets received from 2.1.1.1 DIGITIZE REPORTS.

2.1.1 Outputs

- TARGET_COUNTS - A count of the radar returns for a radar site;
- TARGET_ERROR_COUNTS - A count of the errors in the radar returns for a radar site. The count is used to check the status of the sites.

2.1.2 Radar Report Filter

2.1.2 Description

The RADAR REPORT FILTER object shall reduce the number of radar returns to be processed. Radar returns shall be discarded if they are received from failed radar sites.

Masking is the process of filtering radar data by area, and is used to reduce the number of radar returns to be processed by the remaining subprograms. Areas with more than double radar coverage are considered for masking, which is applied selectively on a Rho,Theta basis for each radar. The mask for each radar is controlled by the adaptation parameters which is used to compensate for radar failures.

The state transition digram describing the behavior of the RADAR REPORT FILTER object for transitioning between radar validity states is depicted in Figure 25 on page 65.

2.1.2 Inputs

- DIGITIZED_RADAR_REPORTS - Digitized radar targets received from 2.1.1.1 DIGITIZE REPORTS
- RADAR_RESET - Notification of a reset of a primary or secondary radar site;
- RADAR_FAILURE_NOTIFICATION - Notification of the failure of a primary or secondary radar site;
- JAMMED_RADAR_REPORTS - Radar reports that are declared invalid due to a jamming condition.
- RADAR_COVERAGE (DATA STORE) - to provide radar coverage data for center, for filtering purposes.

2.1.2 Outputs

- BAD_SITE_RADAR_DATA - Radar data that is received from a radar site that has a failure status. The data is discarded;
- FILTERED_TARGET_REPORTS - Target Reports that have been filtered to only have nonstationary targets from good sites and nonrestricted area.

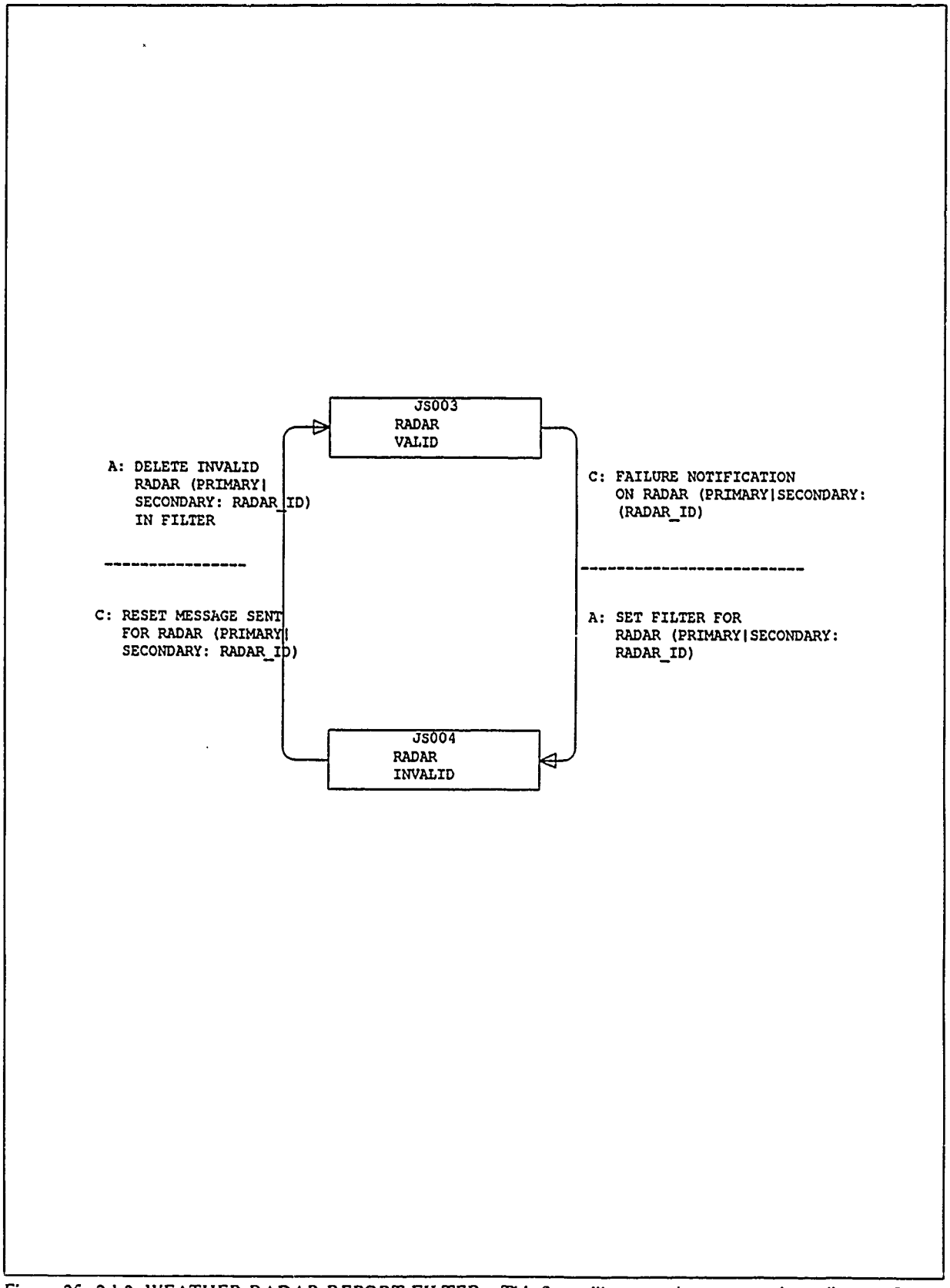


Figure 25. 2.1.2 WEATHER RADAR REPORT FILTER. This figure illustrates the state transition diagram for changing between two states, namely: RADAR VALID and RADAR INVALID.

2.1.3 ECM Detection

2.1.3 Description

The ECM DETECTOR object shall identify radar returns that have originated in an area which is being jammed by electromagnetic counter measures.

2.1.3 Inputs

- DIGITIZED_RADAR_REPORTS - Digitized radar targets received from 2.1.1.1 DIGITIZE REPORTS.

2.1.3 Outputs

- JAMMED_RADAR_REPORTS - Radar reports that are declared invalid due to a jamming condition.

2.1.4 Non-Target Data Processing

2.1.4 Description

Non-target as well as target messages are received from the primary and secondary radar sites. Non-Target Processing monitors the test and status messages, generates a strobe message, and forwards the map messages to weather surveillance processing.

A status message indicates one or more of several radar site problems. The radar sites send fixed search and fixed beacon test messages that are examined by Non-Target Processing to evaluate equipment and site performance. The messages are compared with correct values in the adaptation and should one of the parameters not be within acceptable tolerance, a test message error is output.

If a jamming report is issued due to electromagnetic counter measures, a strobe message is issued. The strobe information notifies the computer that certain azimuth wedges have been blanked out because they were completely filled by some interfering signal such as excess fruit or interference from some nearby radar.

2.1.4 Inputs

- JAMMED_RADAR_REPORTS - Radar reports that are declared invalid due to a jamming condition;
- FILTERED_TARGET_REPORTS - Target Reports that have been filtered to only have nonstationary targets from good sites and nonrestricted area.

2.1.4 Outputs

- RADAR_STROBE_MESSAGE - A message indicating that jamming of primary or secondary radar site data is in effect or is no longer in effect;
- RADAR_TEST_STATUS_MESSAGES - A test or status message reveived from a radar site indicating equipment status.

2.1.1.1 Digitize Weather Reports Discussion

Target positions are determined from the range and azimuth from the radar site, and are provided on all detected targets by search and beacon radar. The resulting analog signals are digitized. Radar reports are provided by both the primary and secondary radar. 2.1.1.1 DIGITIZE WEATHER REPORTS is shown in Figure 26 on page 68

Primary Radar The search radar ground station detects aircraft, ground clutter, and weather clutter resulting from reflection of signals transmitted from the ground station.

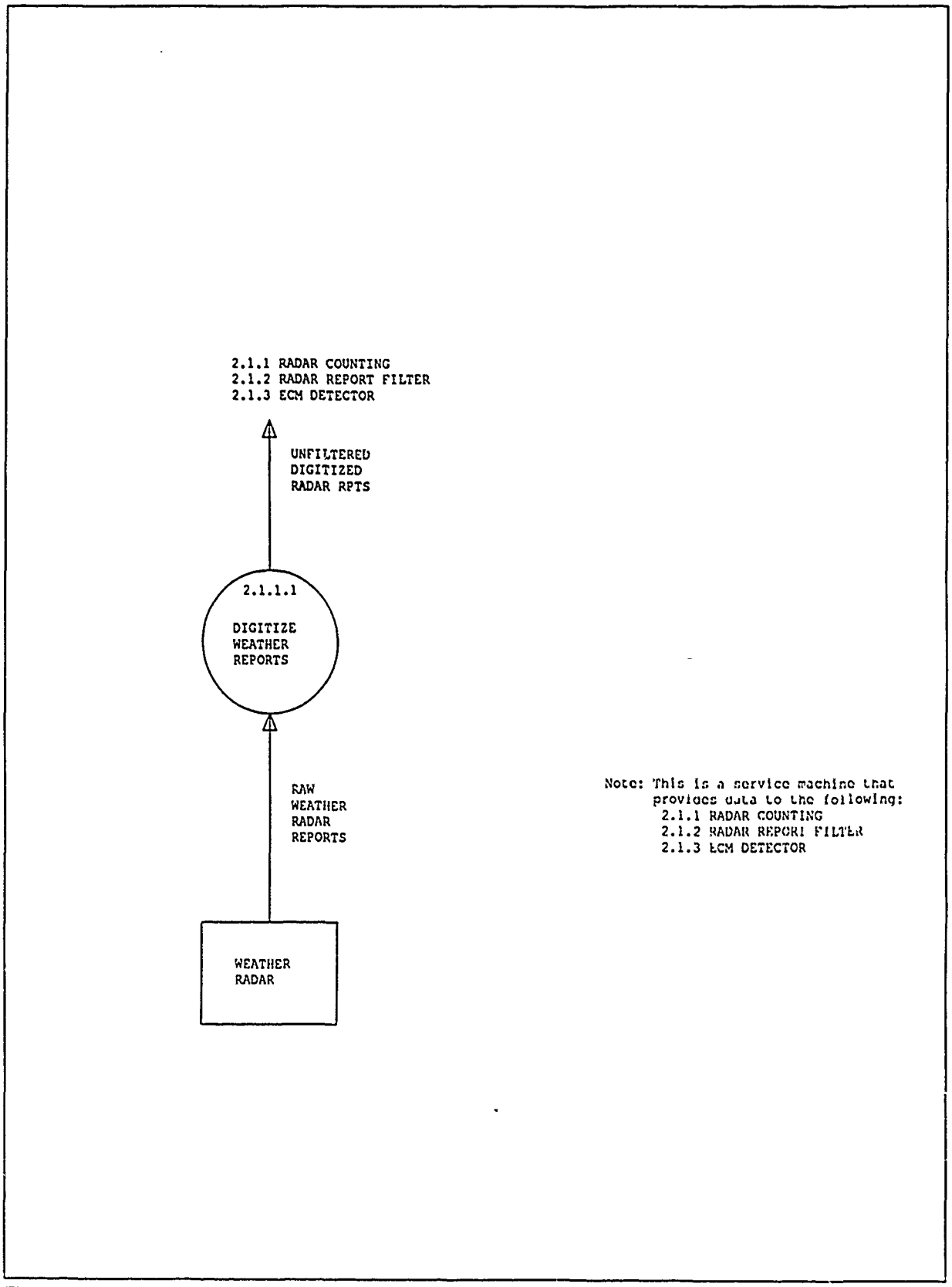


Figure 26. 2.1.1.1 DIGITIZE WEATHER REPORTS. This figure illustrates DIGITIZE WEATHER REPORTS receiving raw reports from the PRIMARY RADAR and the SECONDARY RADAR. DIGITIZE WEATHER REPORTS is an IOM primitive.

2.1.1.1 Inputs

- RAW_WEATHER_RADAR_REPORTS - Raw radar reports produced from the WEATHER RADAR(s).

2.1.1.1 Outputs

- UNFILTERED_DIGITIZED_REPORTS - Digitized radar reports that have come from good radar sites, failed radar sites, and jammed radar sites.

Section Supplement

This section provides summary reports on data employed and derived by the functional object 2.0 Weather Surveillance.

"All Data Flows" Report

Refer to the data flows section presented in 1.0 Traffic Surveillance.

"All Data Stores" Report

Refer to the data stores section presented in 1.0 Traffic Surveillance. Appendix A provides a report of globally defined data stores available to all functional objects.

3.0 Prediction and Resolution

Introduction

The Prediction and Resolution Major Functional Object predicts and resolves conflicts, whether aircraft to aircraft conflicts, or aircraft to ground conflicts.

The PREDICTION AND RESOLUTION object will be introduced by four graphics, namely:

- The Prediction and Resolution View From
- The Prediction and Resolution Interfaces
- The Prediction and Resolution Functional Object Tree
- Prediction and Resolution.

3.0 Prediction and Resolution "View From"

The Prediction and Resolution object, shown in Figure 27 on page 72, acts upon surveillance data and flight plan data to predict and resolve imminent and future conflicts. It receives Traffic Surveillance Data from 1.0 Traffic Surveillance. Although it uses the Flight Plan data store in it's predictions, new or updated flight plans are passed from 7.0 Flight Plan Operations Support, to be checked for future conflicts. Returned to 7.0 are any identified Conflict Situations. Prediction and Resolution also uses Weather Surveillance Information, passed from 2.0 Weather Surveillance. Conflict Resolution Requests may be submitted by the 8.0 Area Control and 8.0 constantly receives the latest conflict Analysis Results Display. Prediction and Resolution also uses data stores Airport and Airport Status, Aircraft and Environment Data, and Track History Data. It logs any pertinent information by sending Analysis Log to 4.0 Recording Support.

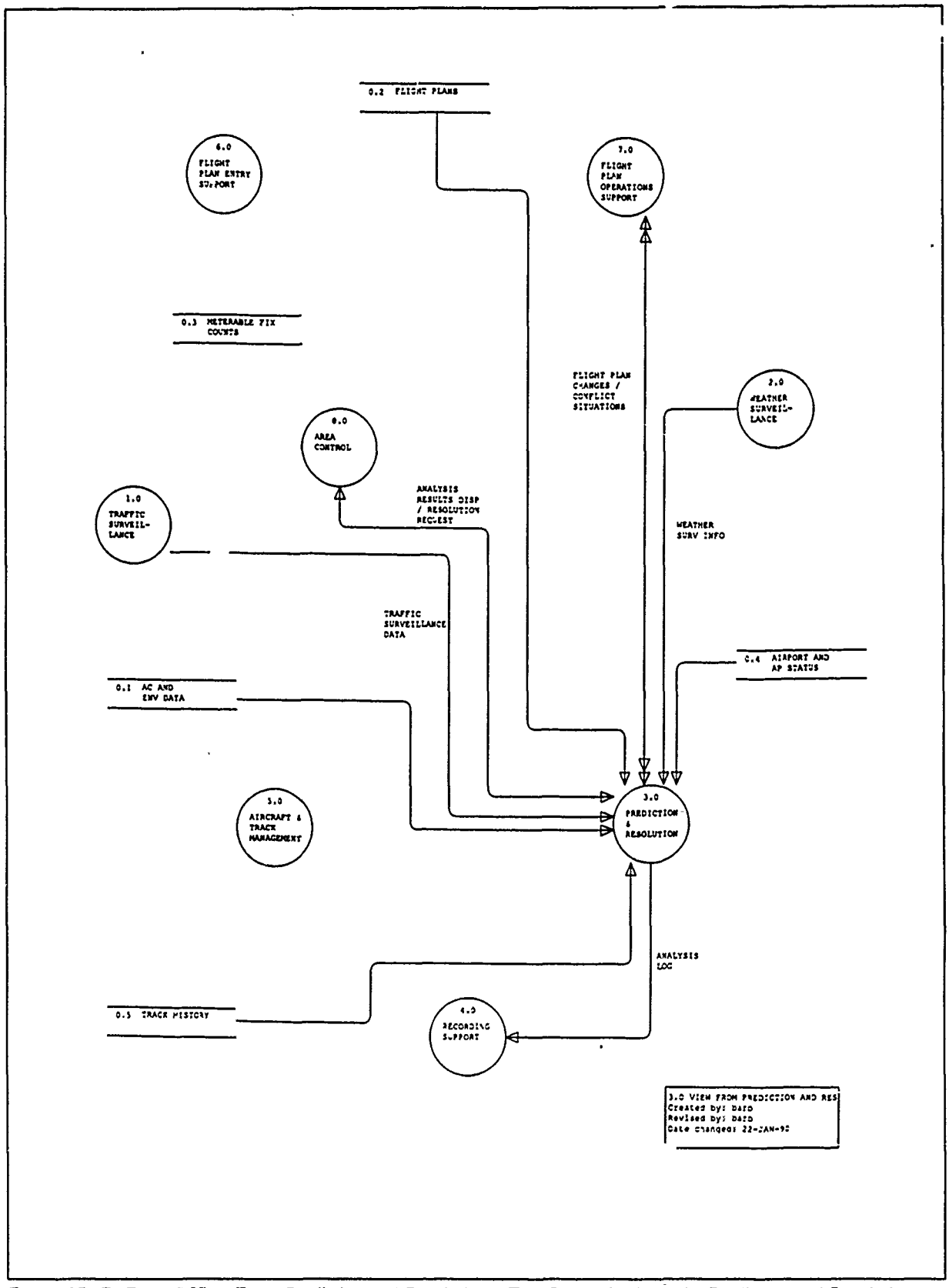


Figure 27. DoD AAS View From Prediction and Resolution. This figure highlights the Prediction and Resolution functional object and shows the flow of information to and from the other functional objects in the DoD AAS ATC Model.

3.0 Prediction and Resolution Interfaces

The interfaces to 3.0 Prediction and Resolution are shown in Figure 28 on page 74. It receives Traffic Surveillance Data, which it passes on to 3.1 Tactical Prediction. It receives Resolution Requests, which it passes on to 3.4 Strategic Resolution. It receives Flight Plan Changes, which it passes on to 3.3 Strategic Prediction.

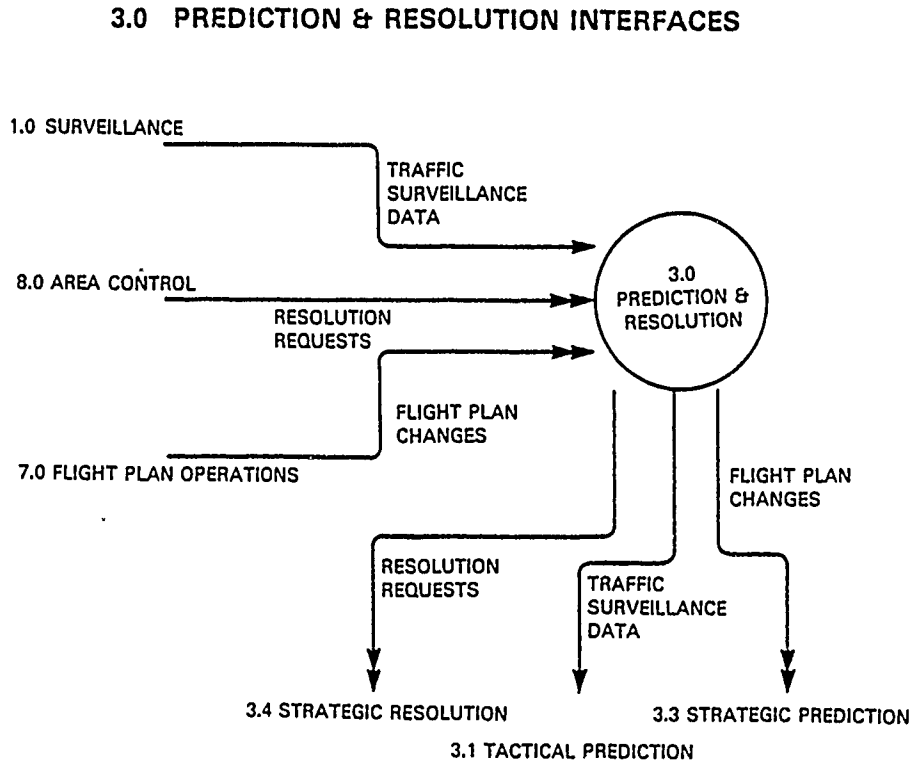


Figure 28. Prediction and Resolution Interfaces. This figure shows the interfaces with the Prediction and Resolution functional object, and the other functional objects of the DoD AAS ATC Model.

3.0 Prediction and Resolution Inputs

- FLIGHT_PLAN_CHANGES - A flight plan whose status has changed. It may have been initiated, amended, or initialized (flight departed).
- RESOLUTION_REQUESTS - Requests from the controller for resolutions to near-term, but not immediate, problems (e.g. flight plan non conform).
- TRAFFIC_SURVEILLANCE_DATA - Traffic Surveillance Data is radar generated data showing the air traffic, includes position, beacon code, altitude.

2.0 Prediction and Resolution Outputs

- FLIGHT_PLAN_CHANGES - A flight plan whose status has changed. It may have been initiated, amended, or initialized (flight departed).
- RESOLUTION_REQUESTS - Requests from the controller for resolutions to near-term, but not immediate, problems (e.g. flight plan non conform).
- TRAFFIC_SURVEILLANCE_DATA - Traffic Surveillance Data is radar generated data showing the air traffic, includes position, beacon code, altitude.

3.0 Prediction and Resolution Functional Object Tree

The functional object tree identifies the communication paths between the functional objects in the Prediction and Resolution process.

Figure 29 on page 76 shows the Functional Object Tree.

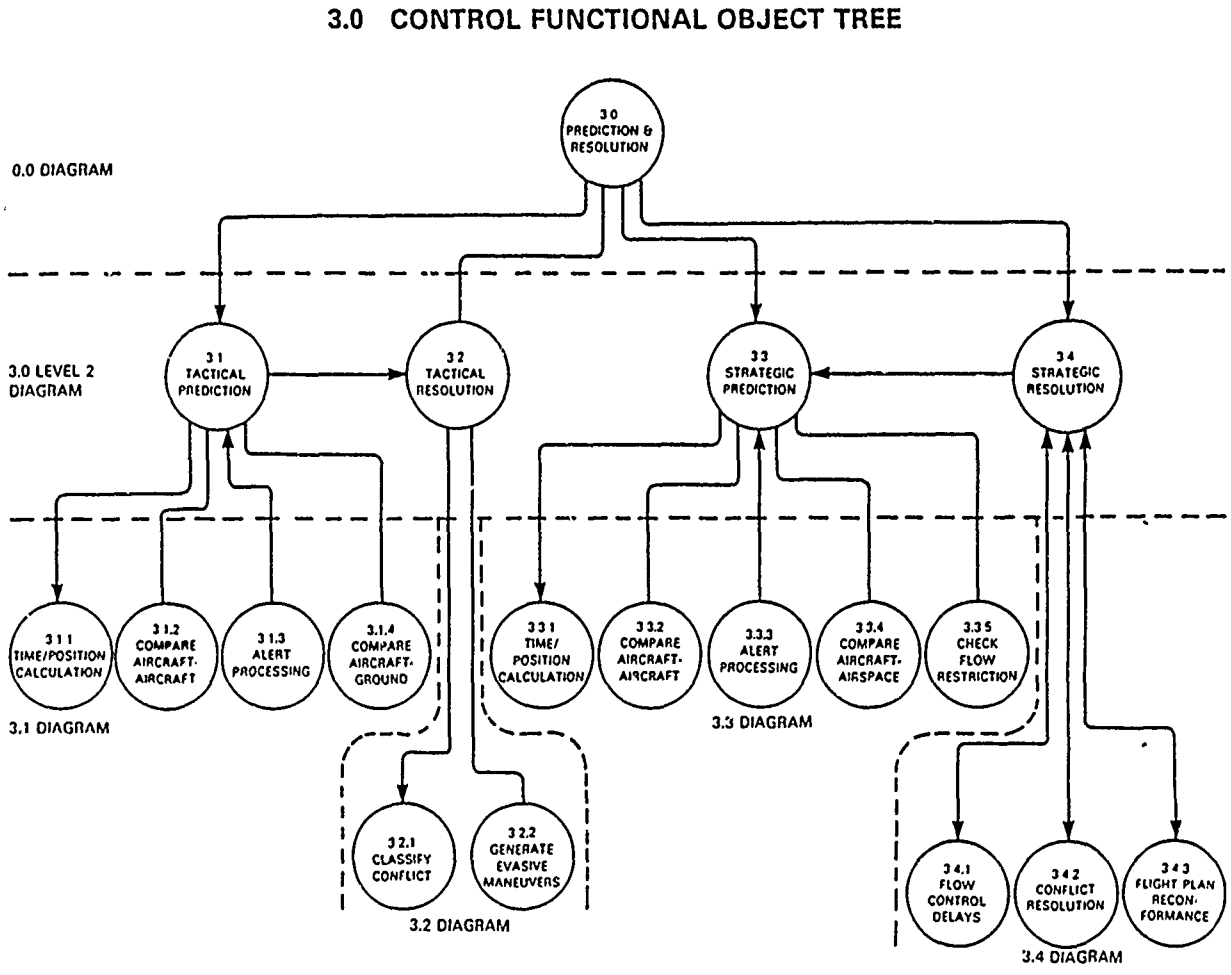


Figure 29. 3 0 Prediction and Resolution Functional Object Tree. This figure illustrates the functional object tree for the Prediction and Resolution Functional Object.

3.0 Prediction and Resolution Discussion

The Prediction and Resolution object, shown in Figure 30 on page 78, passes the following data:

- Surveillance (radar) data to Tactical Prediction to determine if there are airspace conflicts and provide any need maneuvers.
- Flight Plan Updates to Strategic Prediction to predict future airspace conflicts.
- Resolution requests to Strategic Resolution to find controller requested resolutions to in-flight, but not immediate, problems.

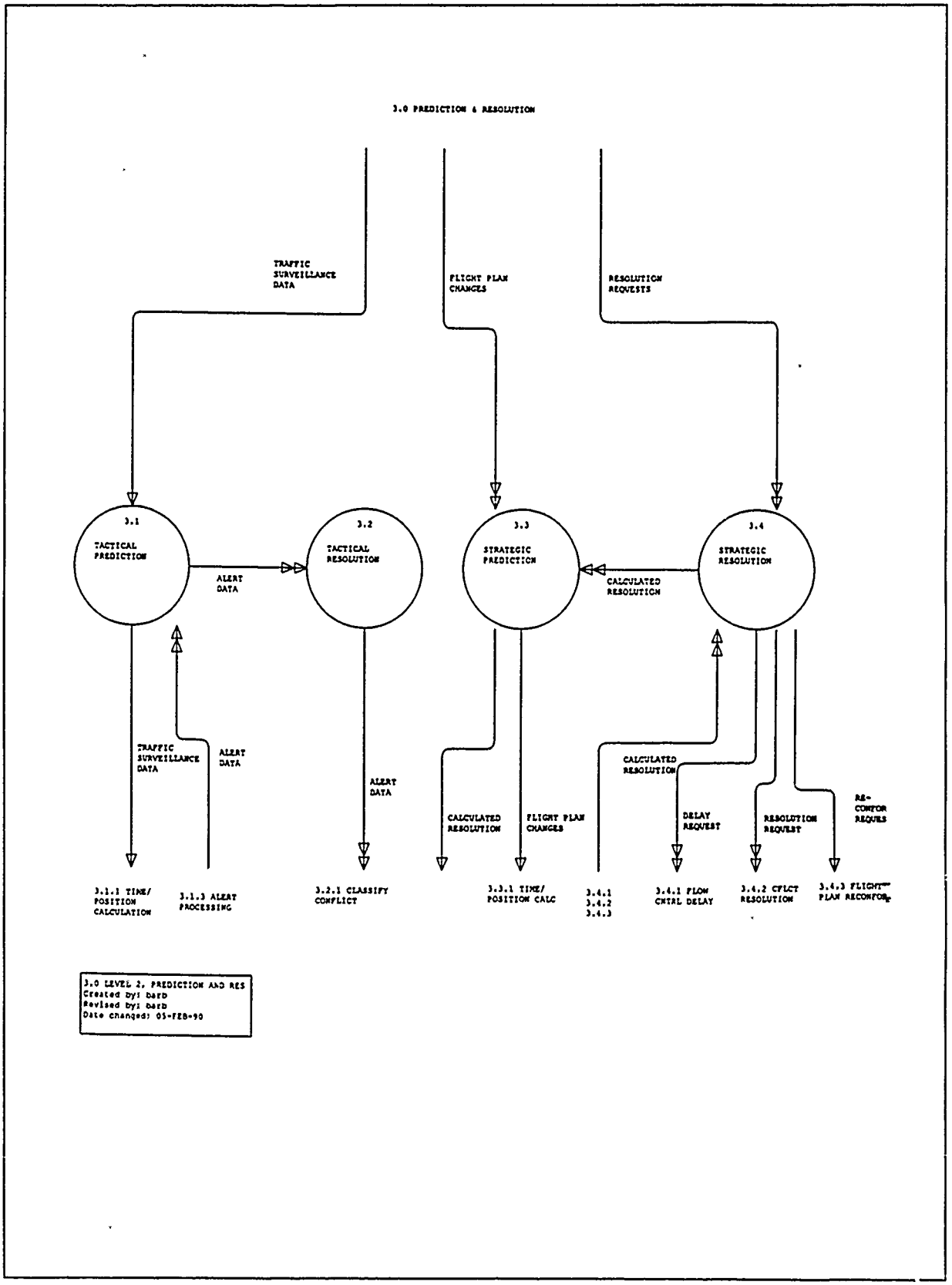


Figure 30. 3.0 Prediction and Resolution. This figure is the IOM object decomposition of the Prediction and Resolution Functional Object.

3.1 Tactical Prediction

3.1 Description

The Tactical Prediction object passes aircraft surveillance data to be used to predict real-time conflicts (aircraft to aircraft and minimum safe altitude). If accepts resulting Alert Data and passes it to the Tactical R3solution object to generate a list of potential evasive maneuvers.

3.1 Inputs

- TRAFFIC_SURVEILLANCE_DATA - Traffic Surveillance Data is radar generated data showing the air traffic, includes position, beacon code, altitude.
- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.

3.1 Outputs

- TRAFFIC_SURVEILLANCE_DATA - Traffic Surveillance Data is radar generated data showing the air traffic, includes position, beacon code, altitude.
- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.

3.2 Tactical Resolution

3.2 Description

The Tactical Resolution object accepts alert data from the Tactical Prediction function to be used to compute up to 4 evasive maneuvers to be presented to the controller in order to resolve the alert/conflict.

3.2 Inputs

- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.

3.2 Outputs

- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.

3.3 Strategic Prediction

3.3 Description

The Strategic Prediction object passes on flight plan changes (and calculated resolutions from Strategic Resolution) to be evaluated to determine if any in-flight conflicts will arise, such as aircraft to aircraft conflicts, aircraft to special-use airspace violations, or flow control constraint violations.

3.3 Inputs

- FLIGHT_PLAN_CHANGES - A flight plan whose status has changed. It may have been initiated, amended, or initialized (flight departed).
- CALCULATED_RESOLUTION - Resolutions calculated by the Strategic Resolution function, in response to controller request for resolution.

3.3 Outputs

- FLIGHT_PLAN_CHANGES - A flight plan whose status has changed. It may have been initiated, amended, or initialized (flight departed).
- CALCULATED_RESOLUTION - Resolutions calculated by the Strategic Resolution function, in response to controller request for resolution.

3.4 Strategic Resolution

3.4 Description

The Strategic Resolution object accepts resolution requests from the controller in 3 forms: delay request, resolution request, and reconformance request. If finds resolutions to these requests which are passed on to the Strategic Prediction object to look for potential conflicts.

3.4 Inputs

- RESOLUTION_REQUESTS - Requests from the controller for resolutions to near-term, but not immediate, problems (e.g. flight plan non conform).
- CALCULATED_RESOLUTION - Resolutions calculated by the Strategic Resolution function, in response to controller request for resolution.

3.4 Outputs

- DELAY_REQUEST - Request from controller to delay an aircraft's progress in order to avoid over-crowding at specific places.
- RECONFORMANCE_REQUEST - Request from the controller for aid in bringing a strayed flight back into conformance with its flight plan.
- RESOLUTION_REQUEST - Request from the controller for aid, in the form of potential solution, in resolving an identified conflict.
- CALCULATED_RESOLUTION - Resolutions calculated by the Strategic Resolution function, in response to controller request for resolution.

3.1 Tactical Prediction Discussion

The 3.1 Tactical Prediction function passes on Traffic Surveillance Data to 3.1.1 Time/Position Calculation which predicts aircraft positions minutes into the future. This data is used to identify potential conflicts. The children of 3.1 Tactical Prediction are shown in Figure 31 on page 82.

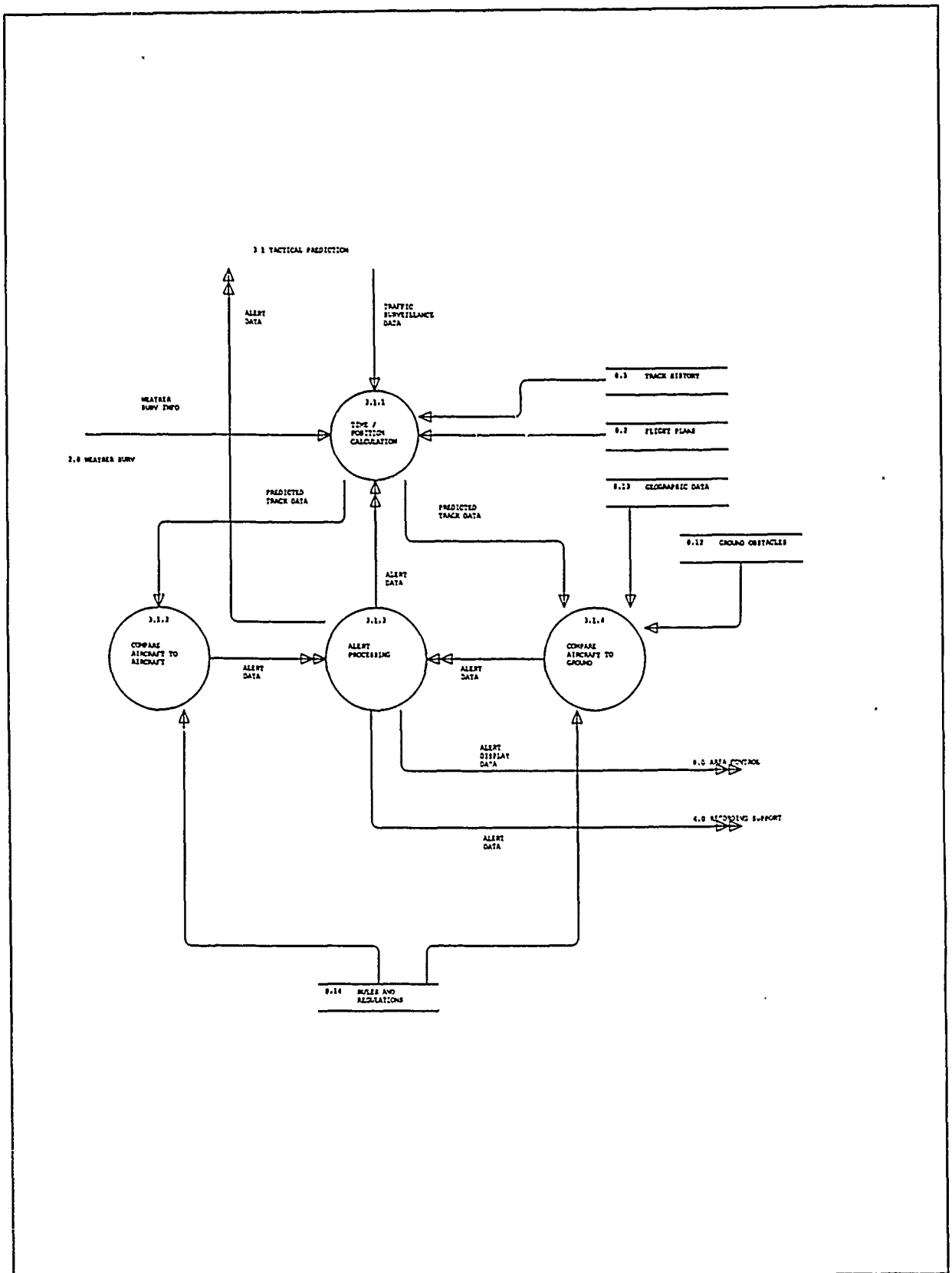


Figure 31. 3.1 Tactical Prediction DFD. This figure is the data flow diagram for the IOM Object, 3.1 Tactical Prediction.

3.1.1 Time/Position Calculation

3.1.1 Description

The Time/Position calculation object performs the following:

- For an established length of time (e.g. 5 minutes), this object steps through incrementally (e.g. every 10 seconds) to produce a new predicted picture of the track positions. The prediction is based on the aircraft/track's past behavior or track history.
- Each incremental picture is passed on to 3.1.2 (Compare Aircraft to Aircraft) and 3.1.4 (Compare Aircraft to Ground) to assess conflicts.

Weather Data is also examined when determining a track's future path.

3.1.1 Inputs

- TRAFFIC_SURVEILLANCE_DATA - Traffic Surveillance Data is radar generated data showing the air traffic, includes position, beacon code, altitude.
- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.
- WEATHER_SURV_INFO - Weather information in the form of radar data and reports on pressure, winds aloft, temperature, etc.

3.1.1 Outputs

- PREDICTED_TRACK_DATA - Predicted track data is predicted positions of known aircraft tracks based on previous track history.

3.1.2 Compare Aircraft to Aircraft

3.1.2 Description

For each predicted picture sent to it by Time/Position Calculation object, the Compare Aircraft to Aircraft object searches aircraft by aircraft for potential collisions. The distances between all aircraft are measured and compared to separation standards, contained in the Rules and Regulations data store. If any conflicts are found, the ALERT DATA is passed to the Alert Processing object.

3.1.2 Inputs

- PREDICTED_TRACK_DATA - Predicted track data is predicted positions of known aircraft tracks based on previous track history.

3.1.2 Outputs

- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.

3.1.3 Alert Processing

3.1.3 Description

The alert processing object accepts ALERT DATA from 3.1.2 Compare Aircraft to Aircraft and 3.1.4 Compare Aircraft to Ground. It assesses the alert for severity and passes the ALERT DATA to 8.0 Area Control and 4.0 Recording Support. It also routes the ALERT DATA to 3.1 Tactical Prediction.

3.1.3 Inputs

- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.

3.1.3 Outputs

- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.
- ALERT_DISPLAY_DATA - Data sent by the TACTICAL PREDICTION function to the controller to notify of identified conflicts or alerts.

3.1.4 Compare Aircraft to Ground

3.1.4 Description

For each predicted picture sent by 3.1.1 Time/Position Calculation, the 3.1.4 Compare Aircraft to Ground object compares the predicted/current altitude of each aircraft to established minimum standards (given in the Rules and Regulations data store). If these standards are violated, it sends alert data to 3.1.3 Alert processing.

3.1.4 Inputs

- PREDICTED_TRACK_DATA - Predicted track data is predicted positions of known aircraft tracks based on previous track history.

3.1.4 Outputs

- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.

3.2 Tactical Resolution Discussion

The 3.2 Tactical Resolution object receive alert data from 3.1.1 Tactical Prediction, which it uses to resolve conflicts by generating possible evasive maneuvers. The children of 3.2 Tactical Resolution are shown in Figure 32 on page 86.

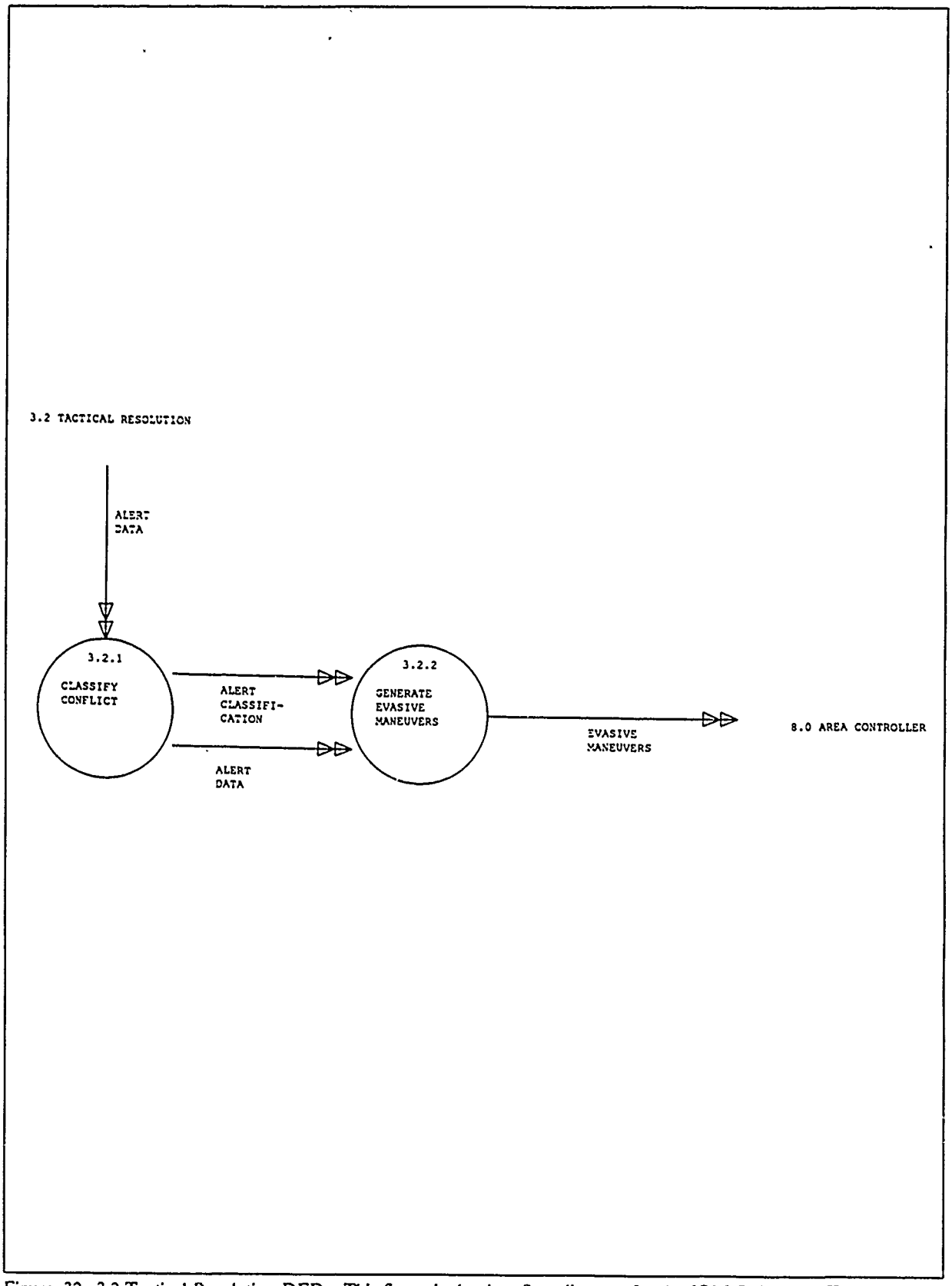


Figure 32. 3.2 Tactical Resolution DFD. This figure is the data flow diagram for the IOM Object, 3.2 Tactical Resolution.

3.2.1 Classify Conflict

3.2.1 Description

The Classify Conflict object assesses the conflict passed to it by 3.2 Tactical Resolution (generated by 3.1 Tactical Prediction). The classification are in the form of Warning, Serious, or Critical.

3.2.1 Inputs

- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.

3.2.1 Outputs

- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.
- ALERT_CLASSIFICATION - Classification of the alert as Warning, Serious, or Critical.

3.2.2 Generate Evasive Maneuvers

3.2.2 Description

The Generate Evasive Maneuver object uses a complex algorithm to generate potential maneuvers to be communicated by the controller to a pilot in order to avoid an imminent conflict (collision with another aircraft or the ground). These maneuvers include turns, climbs, descends, increase/decrease power, or a combination of these.

3.2.2 Inputs

- ALERT_DATA - Data describing a conflict between an aircraft and another aircraft or an aircraft and the ground.
- ALERT_CLASSIFICATION - Classification of the alert as Warning, Serious, or Critical.

3.2.2 Outputs

- EVASIVE_MANEUVERS - Maneuvers generated to avoid imminent conflict. Composed of turns, acceleration/decelerations, altitude changes.

3.3 Strategic Prediction Discussion

The 3.3 Strategic Prediction object receives Flight Plan Changes from 3.0 Prediction and Resolution and Calculated Resolutions from 3.4 Strategic Resolution which it passes down to 3.3.1 Time/Position Calculation. 3.3.1 models aircraft and airspace into the future and passes predicted data to be checked for conflicts. The children of 3.3 Strategic Prediction are shown in Figure 33 on page 89.

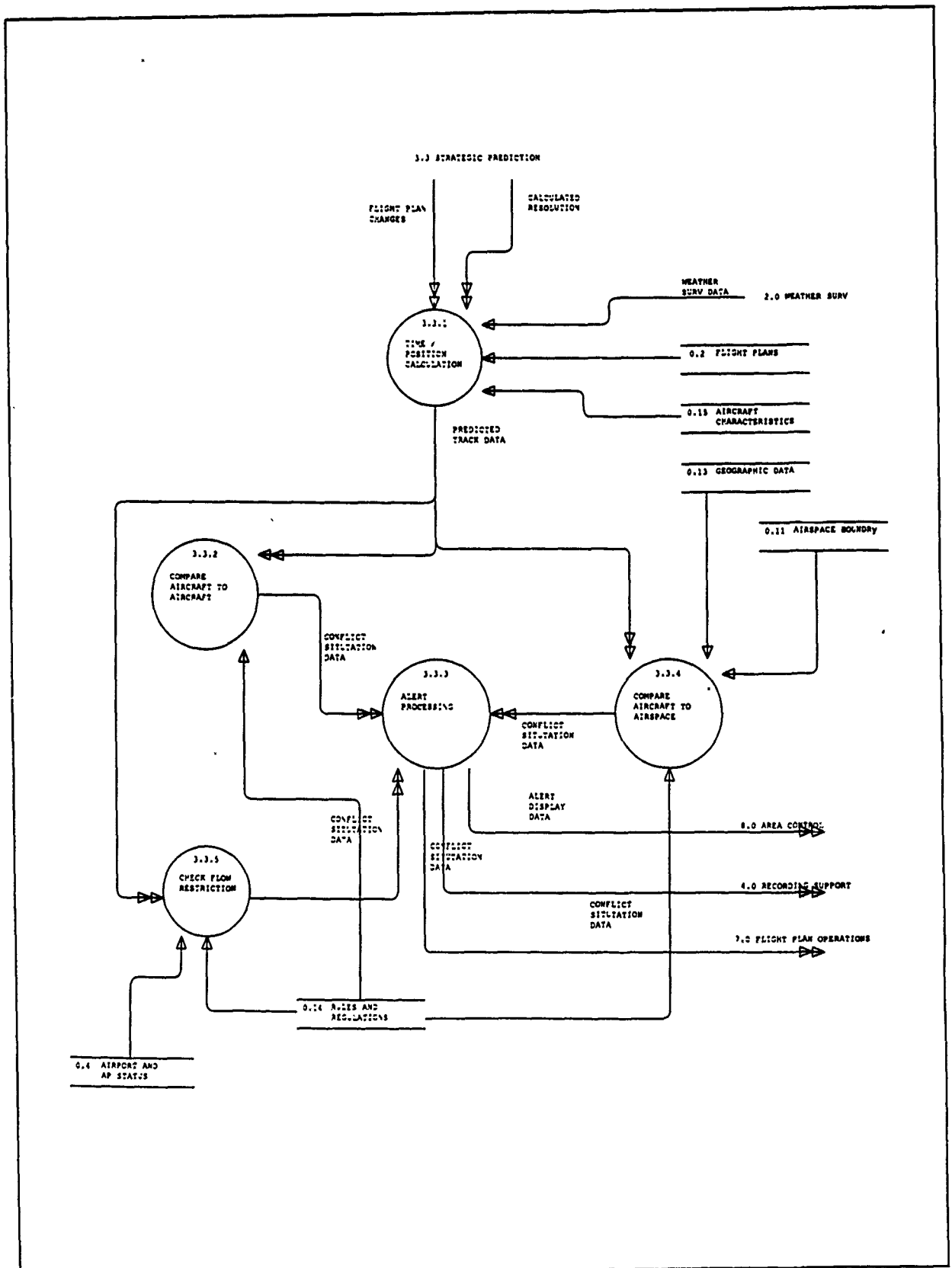


Figure 33. 3.3 Strategic Prediction DFD. This figure is the data flow diagram for the IOM Object, 3.3 Strategic Prediction.

3.3.1 Time/Position Calculation

3.3.1 Description

The Time/Position Calculation object will incrementally produce predicted positions of aircraft based on flight plan and the passed flight plan change data. The prediction process also examines weather data and aircraft characteristics to predict future positions. These incremental pictures are output to be examined for conflicts: aircraft to aircraft, aircraft to airspace; and for flow control constraint violations.

3.3.1 Inputs

- FLIGHT_PLAN_CHANGES - A flight plan whose status has changed. It may have been initiated, amended, or initialized (flight departed).
- CALCULATED_RESOLUTION - Resolutions calculated by the Strategic Resolution function, in response to controller request for resolution.
- WEATHER_SURV_INFO - Weather information in the form of radar data and reports on pressure, winds aloft, temperature, etc.

3.3.1 Outputs

- PREDICTED_TRACK_DATA - Predicted track data is predicted positions of known aircraft tracks based on previous track history.

3.3.2 Compare Aircraft to Aircraft

3.3.2 Description

The Compare Aircraft to Aircraft object examines the predicted position of aircraft at a particular time, as generated by 3.3.1 Time/Position Calculation. It compares every aircraft's position to every other aircraft's position and checks against separation standards contained in Rules and Regulations data store. If the separation is less than the standard, a conflict situation record is generated and sent to 3.3.3 Alert Processing.

3.3.2 Inputs

- PREDICTED_TRACK_DATA - Predicted track data is predicted positions of known aircraft tracks based on previous track history.

3.3.2 Outputs

- CONFLICT_SITUATION_DATA - Data concerning a particular conflict which has been identified.

3.3.3 Alert Processing

3.3.3 Description

The Alert Processing object receives alerts from 3.3.2 Compare Aircraft to Aircraft, 3.3.4 Compare Aircraft to Airspace, and 3.3.5 Check Flow restrictions. It classifies the alert and generates conflict data for the controller, Recording Support, and 3.3 Strategic Prediction.

3.3.3 Inputs

- CONFLICT_SITUATION_DATA - Data concerning a particular conflict which has been identified.

3.3.3 Outputs

- CONFLICT_SITUATION_DATA - Data concerning a particular conflict which has been identified.
- ALERT_DISPLAY_DATA - Data sent by the TACTICAL PREDICTION function to the controller to notify of identified conflicts or alerts.

3.3.4 Compare Aircraft to Airspace

3.3.4 Description

The Compare Aircraft to Airspace object examines the predicted positions of aircraft as passed to it by 3.3.1 Time/Position Calculation. Each aircraft's position is examined to see if it violates any special use airspace restriction. If a violation is found, it is sent in the form of conflict situation data to 3.3.3 Alert Processing.

3.3.4 Inputs

- PREDICTED_TRACK_DATA - Predicted track data is predicted positions of known aircraft tracks based on previous track history.

3.3.4 Outputs

- CONFLICT_SITUATION_DATA - Data concerning a particular conflict which has been identified.

3.3.5 Check Flow Restriction

3.3.5 Description

The check Flow Restriction object examines the current/future position aircraft data generated by 3.3.1 Time/Position Calculation. This examination looks at the following:

- Sequencing along established routes: Flight must fly along a given route with certain separation standards intrail.
- Enroute metering: established navigation fixes have established number of flight that can cross within a given timeframe.
- Flow restrictions: includes broken navigation aids or closed airports that are to be avoided.

If any violations are detected, conflict situation data is passed to 3.3.3 Alert Processing.

3.3.5 Inputs

- PREDICTED_TRACK_DATA - Predicted track data is predicted positions of known aircraft tracks based on previous track history.

3.3.5 Outputs

- CONFLICT_SITUATION_DATA - Data concerning a particular conflict which has been identified.

3.4 Strategic Resolution Discussion

The 3.4 Strategic Resolution object receives resolution requests from 3.0 Prediction and Resolution, which it passes to it's children for resolution processing: Flow Control Delay processing, Conflict Resolution processing, or Flight Plan Reconformance processing. The children of 3.4 Strategic Resolution are shown in Figure 34 on page 93.

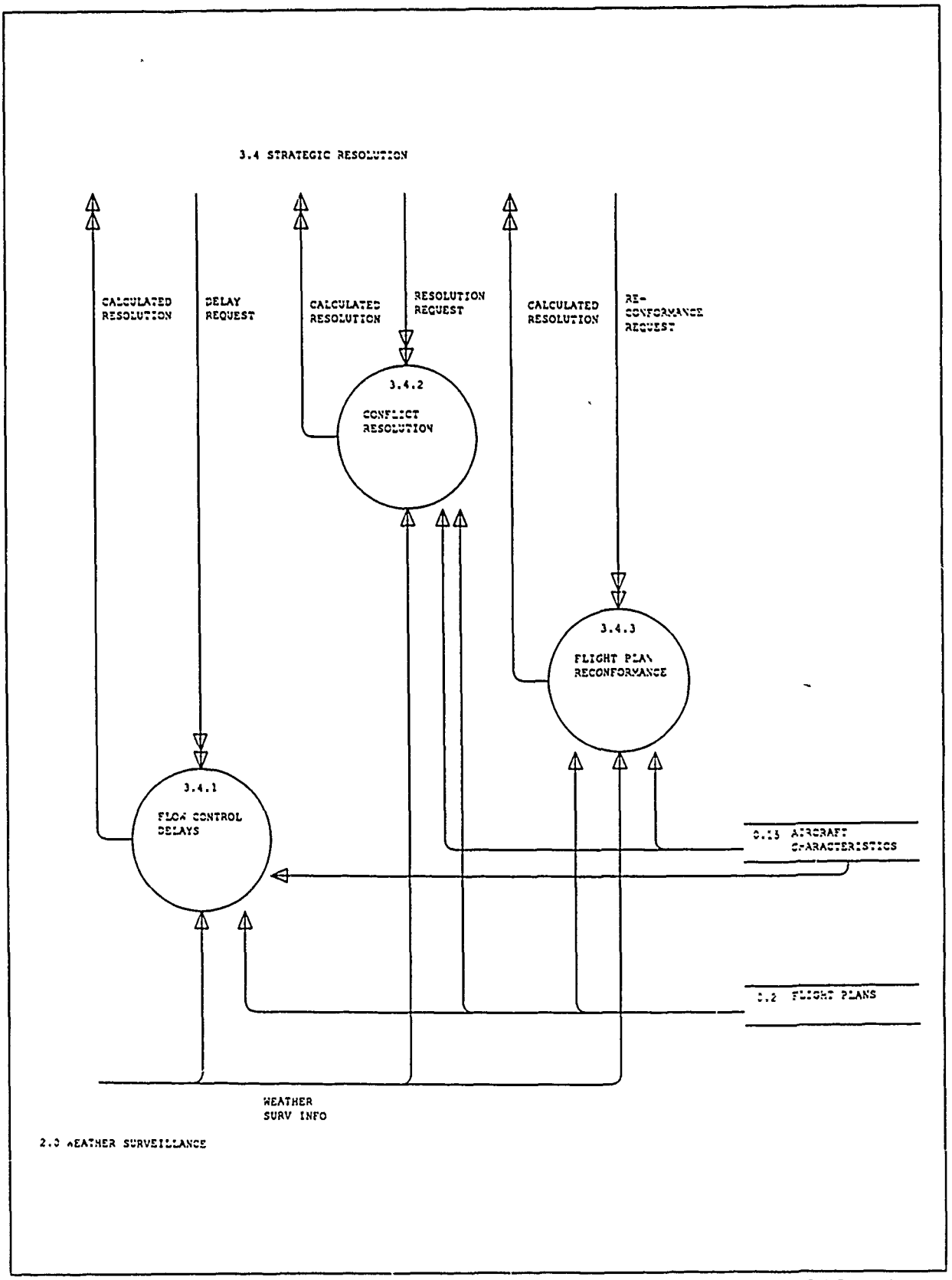


Figure 34. 3.4 Strategic Resolution DFD. This figure is the data flow diagram for the IOM Object, 3.4 Strategic Resolution.

3.4.1 Flow Control Delays

3.4.1 Description

The Flow Control Delays object generates aircraft delay requests in order to avoid overcrowding a particular piece of airspace. This results in a trial flight plan which is sent via 3.4 to 3.3 Strategic Prediction for evaluation. This object is invoked by 8.0 Area Control request for flow control delay processing.

3.4.1 Inputs

- DELAY_REQUEST - Request from controller to delay an aircraft's progress in order to avoid overcrowding at specific places.
- WEATHER_SURV_INFO - Weather information in the form of radar data and reports on pressure, winds aloft, temperature, etc.

3.4.1 Outputs

- CALCULATED_RESOLUTION - Resolutions calculated by the Strategic Resolution function, in response to controller request for resolution.

3.4.2 Conflict Resolution

3.4.2 Description

The Conflict Resolution object responds to a request by the controller for aid in resolving an identified conflict. Trial flight plans are generated, in the form of calculated resolutions, which are sent through 3.4 to 3.3 Strategic Prediction for evaluation.

3.4.2 Inputs

- RESOLUTION_REQUEST - Request from the controller for aid, in the form of potential solution, in resolving an identified conflict.
- WEATHER_SURV_INFO - Weather information in the form of radar data and reports on pressure, winds aloft, temperature, etc.

3.4.2 Outputs

- CALCULATED_RESOLUTION - Resolutions calculated by the Strategic Resolution function, in response to controller request for resolution.

3.4.3 Flight Plan Reconformance

3.4.3 Description

The Flight Plan Reconformance object is invoked upon 8.0 area control request to generate a trail flight plan which would bring a flight which strayed from its flight plan back on course. This trial flight plan, in the form of a calculated resolution, is sent via 3.4 to 3.3 Strategic Prediction.

3.4.3 Inputs

- RECONFORMANCE_REQUEST - Request from the controller for aid in bringing a strayed flight back into conformance with its flight plan.
- WEATHER_SURV_INFO - Weather information in the form of radar data and reports on pressure, winds aloft, temperature, etc.

3.4.3 Outputs

- CALCULATED_RESOLUTION - Resolutions calculated by the Strategic Resolution function, in response to controller request for resolution.

Section Supplement

This section provides summary reports on data employed and derived by the functional object 3.0 Prediction and Resolution.

"All Data Flows" Report

The following report, generated from the Excelerator database, identifies all data flows for the Prediction and Resolution object.

Name	Alternate Name	Short Descrip.	Last Modify Date
H0118	ALERT CLASSIFICATION	CLASSIFICATION OF THE ALERT AS WARNING, SERIOUS, CRITICAL.	900122
H0104	ALERT DATA	DATA DESCRIBING A CONFLICT BETWEEN AN AIRCRAFT AND ANOTHER AIRCRAFT OR AN AIRCRAFT AND THE GROUND.	900122
H0117	ALERT DISPLAY DATA	DATA SENT BY THE TACTICAL PREDICTION FUNCTION TO THE CONTROLLER TO NOTIFY OF IDENTIFIED CONFLICTS OR ALERTS.	900122
H0130	ANALYSIS LOG	DATA LOGGED BY THE 3.0 PREDICTION & ANALYSIS OBJECT AND ITS CHILDREN	900122
H0109	ANALYSIS RESULTS DISPLAY/RES REQ	RESULTS OF THE PREDICTION AND RESOLUTION OBJECT AND RESOLUTION REQUESTS FROM THE CONTROLLER	900122
H0113	CALCULATED RESOLUTION	RESOLUTIONS CALCULATED BY THE STRATEGIC RESOLUTION FUNCTION, IN RESPONSE TO CONTROLLER REQUEST FOR RESOLUTION.	900122
H0123	COMPARE RESULTS	RESULTS OF COMPARING A FLIGHT'S PATH WITH ITS FLIGHT PLAN TRAJECTORY	900122
H0112	CONFLICT SITUATION	POTENTIAL CONFLICTS UNCOVERED IN THE ANALYSIS OF FLIGHT PLAN DATA, INCLUDING FUTURE AIRCRAFT-TO-AIRCRAFT CONFLICTS.	891218
H0105	CONFLICT SITUATION DATA	DATA CONCERNING A PARTICULAR CONFLICT WHICH HAS BEEN IDENTIFIED	900119
H0103	CORRELATED TRACK DATA	TRACK DATA THAT HAS BEEN CORRELATED WITH AN APPROPRIATE FLIGHT PLAN	900122
H0114	DELAY REQUEST	REQUEST FROM CONTROLLER TO DELAY AN AIRCRAFT'S PROGRESS IN ORDER TO AVOID OVERCROWDING AT SPECIFIC PLACES.	900116
H0119	EVASIVE MANEUVERS	MANEUVERS GENERATED TO AVOID IMMINENT CONFLICT. COMPOSED OF TURNS, ACCELERATION/DECELERATIONS, ALTITUDE CHANGES.	900122
H0102	FLIGHT PLAN CHANGES	A flight plan whose status has changed. It may have been initiated, amended, or initalized (flight departed).	891218
H0111	FLIGHT PLAN CHANGES/CONFLICT SIT	CHANGES IN FLIGHT PLANS DUE TO STATE CHANGES. CONFLICT SITUATIONS RESULTING FROM STRATEGIC PREDICTION.	900122
H0122	FLIGHT PLAN DATA-BLOCK INFO	FLIGHT PLAN INFORMATION TO BE INCLUDED ON THE SURVEILLANCE DISPLAY THAT CORRESPONDS TO SPECIFIC FLIGHT PLANS.	900122
H0121	FLIGHT PLAN EVENT	AN EVENT FOR A FLIGHT PLAN, SUCH AS WHEN IT CROSSES A METERING FIX	900122
H0129	FLIGHT PLAN POSITION	COORDINATE POSITIONS OF AN AIRCRAFT ON A FLIGHT PLAN	900122
H0126	FP EVENT / STATUS	FLIGHT PLAN EVENT, SUCH AS FIX CROSSINGS, AND STATUS, SUCH AS NONCONFORMANCE REPORTS.	900122

Name	Alternate Name	Short Descrip.	Last Modify Date
H0120	NON-CONFORMANCE ALERT	ALERT TO TO BE RECORDED FOR FAILURE OF A FLIGHT TO STAY ON ITS FLIGHT PLAN	900122
H0127	NONCONFORMANCE ALERTS	ALERTS SENT TO RECORDING SUPPORT WHEN A FLIGHT IS OUT OF CONFORMANCE WITH ITS FLIGHT PLAN	891218
H0106	PREDICTED TRACK DATA	PREDICTED TRACK DATA IS PREDICTED POSITIONS OF KNOWN AIRCRAFT TRACKS BASED ON PREVIOUS TRACK HISTORY.	900122
H0115	RECONFORMANCE REQUEST	REQUEST FROM THE CONTROLLER FOR AID IN BRINGING A STRAYED FLIGHT BACK INTO CONFORMANCE WITH ITS FLIGHT PLAN.	900118
H0116	RESOLUTION REQUEST	REQUEST FROM THE CONTROLLER FOR AID, IN THE FORM OF POTENTIAL SOLUTIONS, IN RESOLVING AN IDENTIFIED CONFLICT.	900119
H0108	RESOLUTION REQUESTS	Requests from the controller for resolutions to near-term, but not immediate, problems (e.g. flight plan non conform).	891218
H0124	TRACK CLASSIFICATION	A CLASSIFICATION OF AN IDENTIFIED TRACK, SUCH AS FREE (NO FLIGHT PLAN ASSOC), FLIGHT PLAN AIDED, OR COAST.	900122
H0128	TRACK DISPLAY DATA	DISPLAY DATA CONTAINING FLIGHT DATA BLOCKS AND TRACK CLASSIFICIATIONS.	891218
H0125	TRACK DISPLAY DATA	DATA ABOUT THE IDENTIFIED TRACKS TO BE PRESENTED TO THE CONTROLLER, INCLUDING CORRELATED FLIGHT PLANS AND CLASSIFCTN	900122
H0101	TRAFFIC SURVEILLANCE DATA	Traffic Surveillance Data is radar generated data showing the air traffic, includes position, beacon code, altitude.	900111
H0110	WEATHER SURV INFO	WEATHER INFORMATION IN THE FORM OF RADAR DATA AND REPORTS ON PRESSURE, WINDS ALOFT, TEMPERATURE, ETC.	891218

"All Records and their Elements" Report

The following report, generated from the Excelerator database, identifies all the records and their elements for the Prediction and Resolution object.

Name	=(ELE/REC Name	)+ Definition
ALERT DATA	= ALERT ID	
	+ ALERT TYPE	
	+ AIRCRAFT ID	
	+ PREDICTED TRACK POSITION	
	+ OTHER AIRCRAFT ID	
	+ TIME BEFORE IMPACT	
ALERT DISPLAY DATA	= ALERT ID	
	+ FLIGHT PLAN ID	
	+ AIRCAFT POSITION DATA	
	+ ALERT TYPE	
	+ ALERT INFORMATION	
ANALYSIS LOG	= ALERT DATA	
	+ CONFLICT SITUATION DATA	
ANALYSIS RESULTS DISPLAY	= ALERT DISPLAY DATA	
	+ EVASIVE MANEUVERS	
ANALYSIS RES & RESOLUTION REQ	= ANALYSIS RESULTS DISPLAY	
	+ RESOLUTION REQUEST	
CALCULATED RESOLUTION	= FLIGHT PLAN ID	
	+ PROPOSED FLIGHT PLAN UPDATE	
COMPARE RESULTS	= FLIGHT PLAN ID	
	+ TRACK COAST	
	+ FREE TRACK	
CONFLICT SITUATIONS		
CONFLICT SITUATION DATA	= FLIGHT PLAN ID	
	+ CONFLICT TYPE	
	+ INVOLVED AIRCRAFT	
	+ TIME BEFORE INCIDENT	
CORRELATED TRACK DATA	= TRACK ID	``
	-(FLIGHT PLAN ID	)
	+ FLIGHT POSITION	
DELAY REQUEST	= FLIGHT PLAN ID	
	+ LENGTH OF DELAY	
	+ METERING FIX	
EVASIVE MANEUVERS	= ALERT ID	
	+ MANEUVER	
FLIGHT PLAN DATA BLOCK INFO	= TRACK ID	
	+ FLIGHT PLAN ID	)
	+ SUMMARISED TRACK INFO	

Name	=(ELE/REC Name)+ Definition
FLIGHT PLAN EVENT	= FLIGHT PLAN ID
	+(METER FIX CROSSING)
	+(HANDOFF)
	+(INITIATE TRACKING)
	+(TERMINATE FLIGHT)
FLIGHT PLAN POSITION	= FLIGHT POSITION
FLIGHT PLAN STATUS	= NONCONFORMANCE ALERT
FLIGHT POSITION	= LATITUDE
	+ LONGITUDE
	+(ALTITUDE)
	+(VELOCITY)
FP CHANGES & CONFLICT SITUATIONS	= FLIGHT PLAN CHANGES
	+ CONFLICT SITUATION DATA
FP EVENT / STATUS	= FLIGHT PLAN EVENT
	+ FLIGHT PLAN STATUS
MANEUVER	= COMMAND
	- DIRECTION
	+ DURATION
	+ SPEED
	+ QUALIFIER
NONCONFORMANCE ALERT	= FLIGHT PLAN ID
	+ FLIGHT POSITION
POSITION DATA	
PREDICTED TRACK DATA	= TRACK DATA INSTANCE
RECONFORMANCE REQUEST	= FLIGHT PLAN ID
	+ CURRENT POSITION
RESOLUTION REQUEST	= FLIGHT PLAN ID
	+ CURRENT POSITION
	+ CONFLICT TYPE
SUMMARISED FLIGHT PLAN DATA	= FLIGHT ID
	=(AIRCRAFT TYPE
	= AIRSPEED
	=(DESTINATION)
	= FLIGHT POSITION
	=(BEACON CODE)
SUMMARISED FLIGHT PLAN INFO	
SUMMARISED TRACK DATA	

Name	=(ELE/REC Name	)+ Definition
SUMMARISED TRACK INFO	=(AIRCRAFT ID	)
	+(AIRCRAFT TYPE	)
	+ VELOCITY	
	+ FLIGHT POSITION	
	+(DESTINATION	)
TRACK CLASSIFICATION		
TRACK DATA INSTANCE	= TIME STAMP	
	÷ AIRCRAFT POSITION DATA	
TRACK DISPLAY DATA	= TRACK ID	
	+(FLIGHT PLAN ID	)
	+ TRACK CLASSIFICATION	
	+ SUMMARISED TRACK INFO	

"All Data Stores" Report

3.0 Prediction and Resolution employs the following globally defined data stores defined in Appendix A of this document:

- AIRCRAFT_AND_ENVIRONMENT_DATA
- TRACK_HISTORY
- FLIGHT_PLANS
- AIRPORT_AND_AP_STATUS.

5.0 Aircraft and Track Management

Introduction

5.0 Aircraft and Track Management is responsible for correlating identified aircraft tracks to flight plan data and for identifying when aircraft cross metering fixes.

The AIRCRAFT AND TRACK MANAGEMENT object will be introduced by four graphics, namely:

- The Aircraft and Track Management View From
- The Aircraft and Track Management Interfaces
- The Aircraft and Track Management Functional Object Tree
- Aircraft and Track Management.

5.0 Aircraft and Track Management "View From"

The relationship on 5.0 Aircraft and Track Management to other Major Functional Objects is shown in Figure 35 on page 100. It is activated by Traffic Surveillance Data received from 1.0 Traffic Surveillance. Using data stores Flight Plans and Aircraft and Environment Data, 5.0 generates Non-conformance Alerts to 4.0 Recording Support and Track Display Data to 8.0 Area Control. It also updates the Meterable Fix Counts data store and sends Flight Plan Events and Status to 6.0 Flight Plan Entry Support.

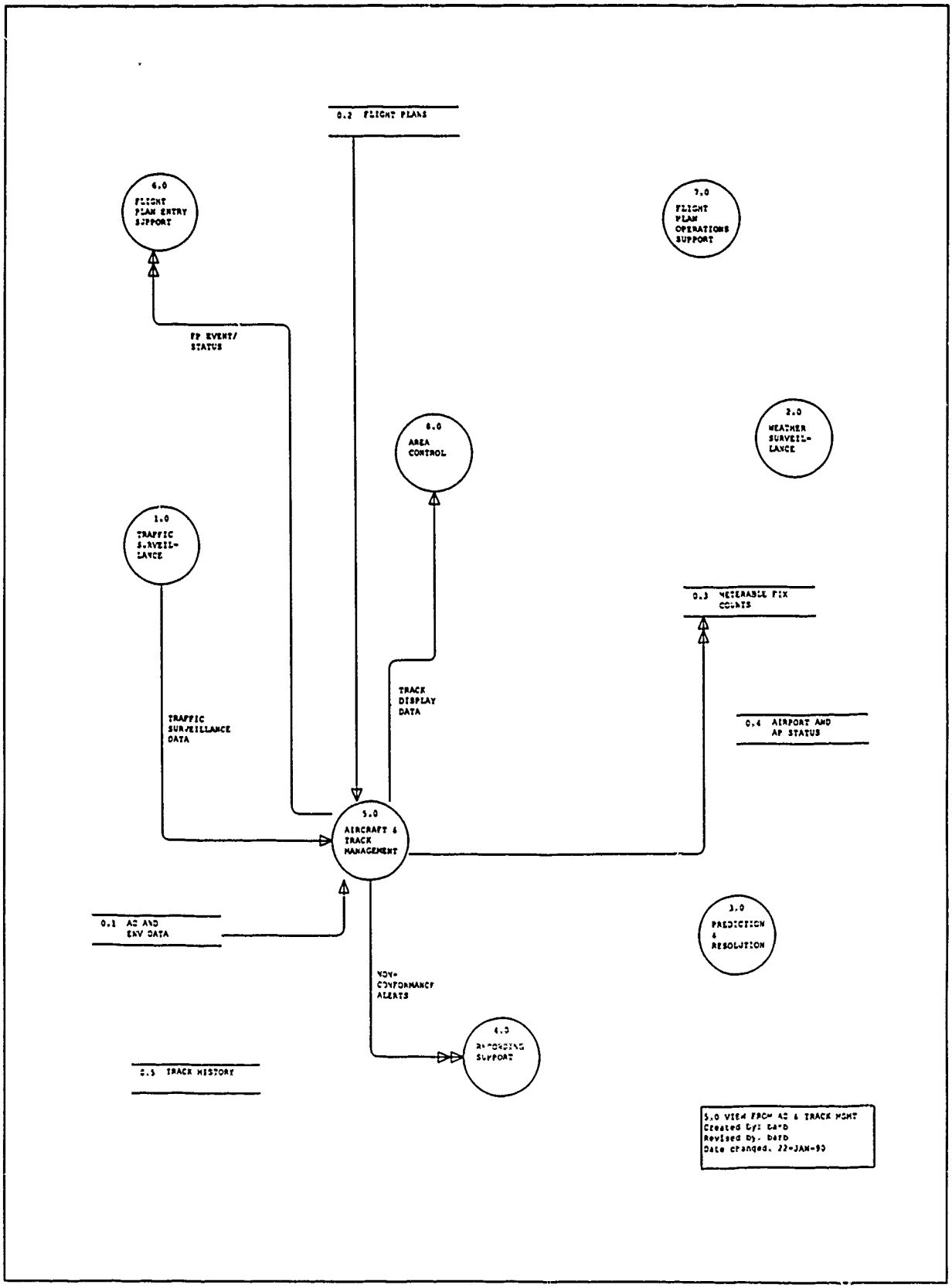


Figure 35. DoD AAS View From Aircraft and Track Management. This figure highlights the Aircraft and Track Management functional object and shows the flow of information to and from the other functional objects in the DoD AAS ATC Model.

5.0 Aircraft and Track Management Interfaces

The interfaces to 5.0 Aircraft and Track Management are shown in Figure 36 on page 102. It passes Traffic Surveillance Data to 5.1 Correlate Track and Flight Plan.

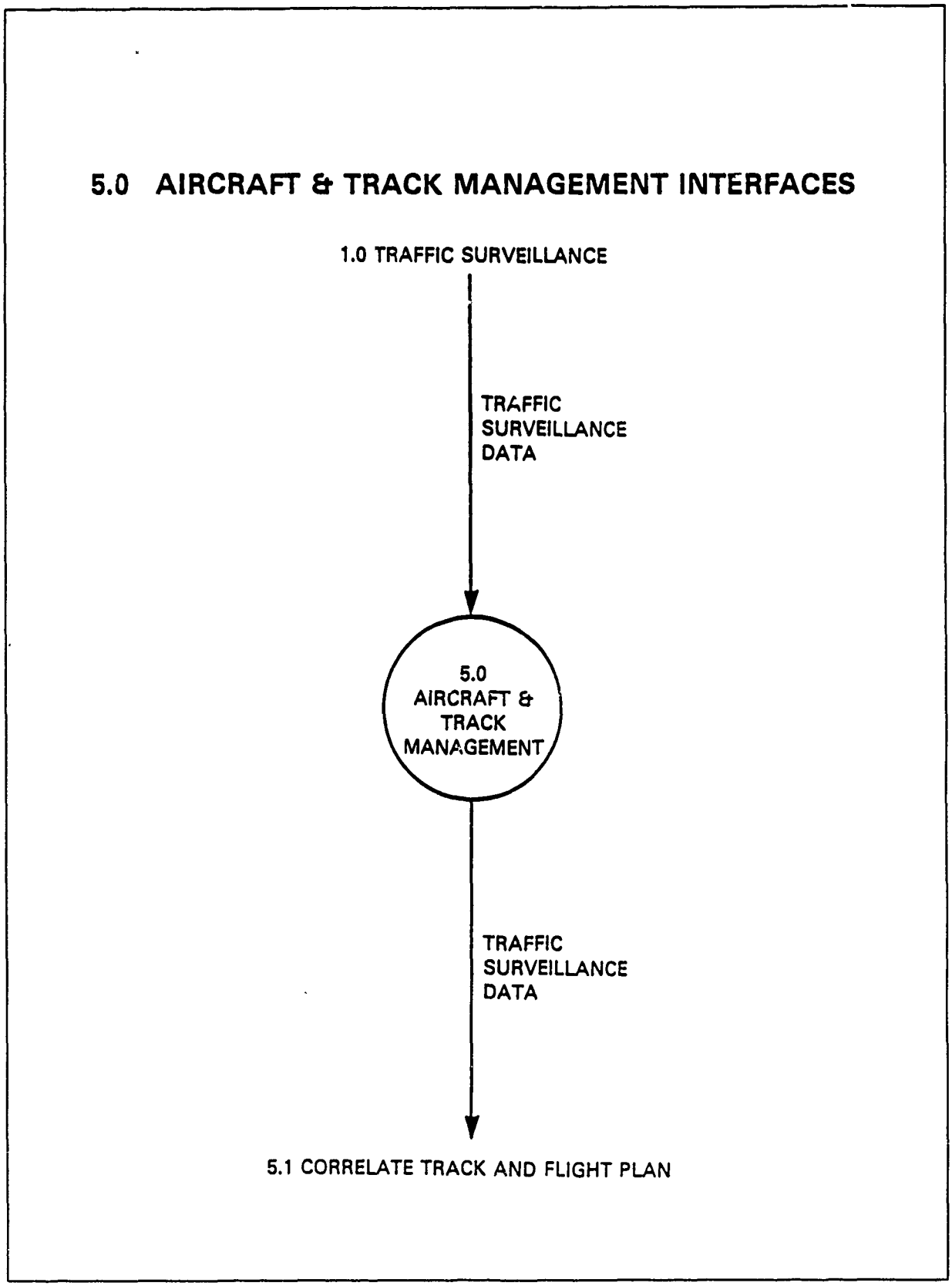


Figure 36. Aircraft and Track Management Interfaces. This figure shows the interfaces with the Aircraft and Track Management functional object, and the other functional objects of the DoD AAS ATC Model.

5.0 Inputs

- TRAFFIC_SURVEILLANCE_DATA - Traffic Surveillance Data is radar generated data showing the air traffic, includes position, beacon code, altitude.

5.0 Outputs

- TRAFFIC_SURVEILLANCE_DATA - Traffic Surveillance Data is radar generated data showing the air traffic, includes position, beacon code, altitude.

5.0 Aircraft and Track Management Functional Object Tree

The functional object tree identifies the communication paths between the functional objects in the Aircraft and Track Management process. Figure 37 on page 104 shows the Functional Object Tree.

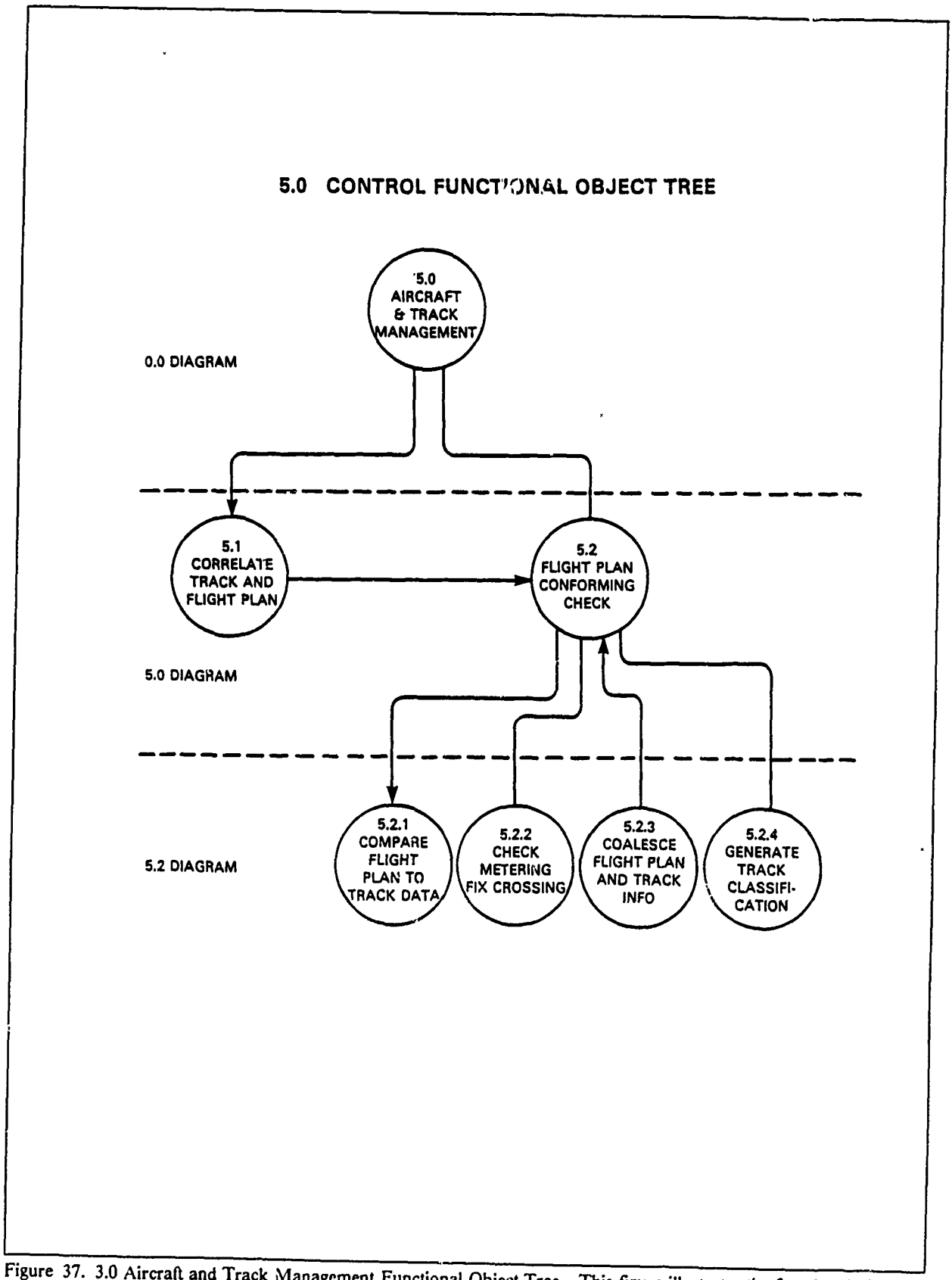


Figure 37. 3.0 Aircraft and Track Management Functional Object Tree. This figure illustrates the functional object tree for the Aircraft and Track Management Functional Object.

5.0 Aircraft and Track Management Discussion

The Aircraft & Track Management object, shown in Figure 38 on page 106, passes flight surveillance data from 1.0 traffic surveillance. This data is used to correlate flight plans to tracks and to check to see if a track has strayed from its flight plan.

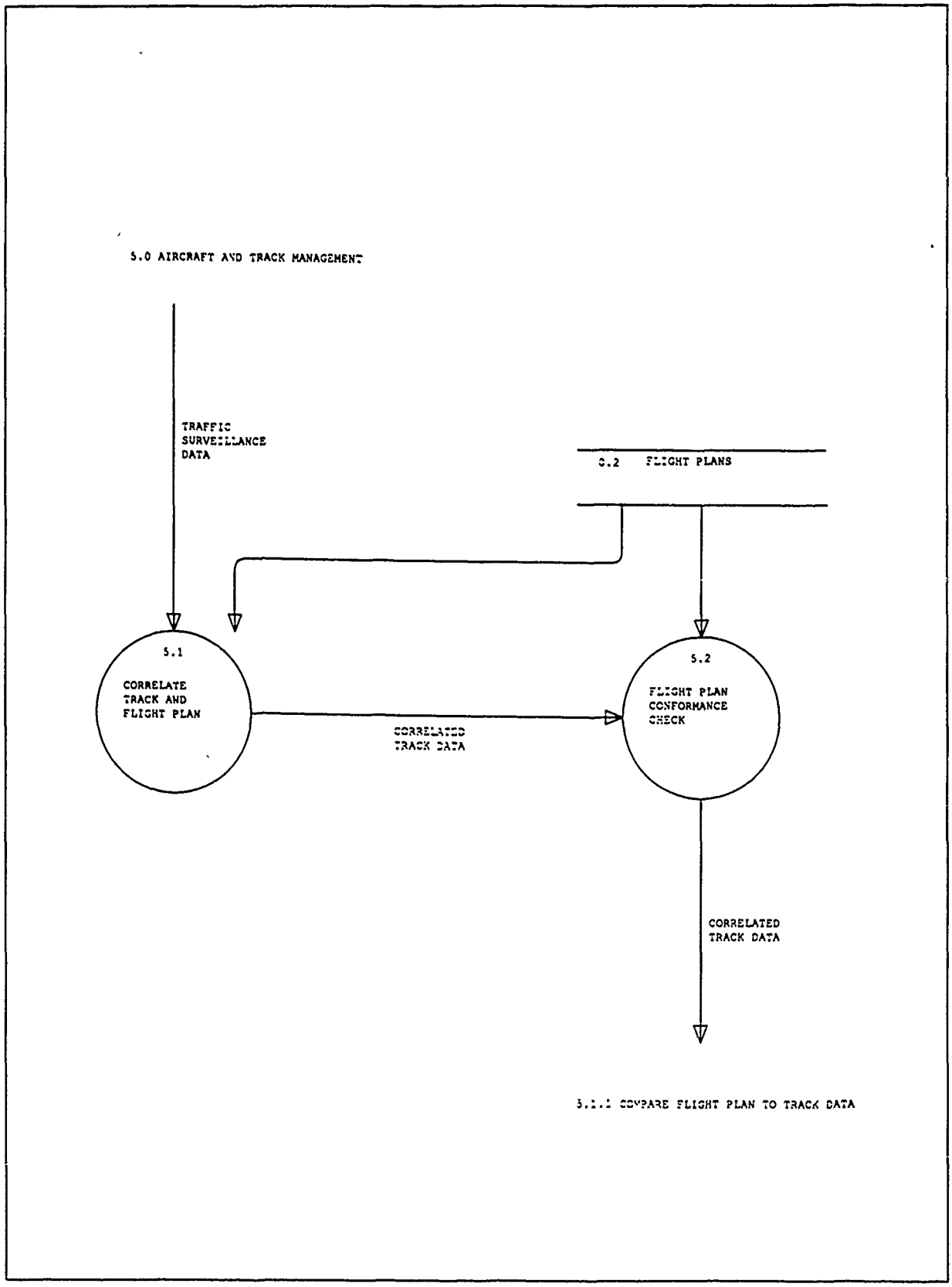


Figure 38. 5.0 Aircraft and Track Management. This figure is the IOM object decomposition of the Aircraft and Track Management Functional Object.

5.1 Correlate Track and Flight Plan

5.1 Description

The Correlate Track and Flight Plan object receives aircraft surveillance data originating in 1.0 Traffic Surveillance. The surveillance data is composed of multiple aircraft tracks, composed of position, altitude, and (possibly) beacon code. If the beacon code exists, the flight plan data base is searched for a flight plan whose assigned beacon code matches it. Flight plan correlation of all tracks is attempted.

5.1 Inputs

- TRAFFIC_SURVEILLANCE_DATA - Traffic Surveillance Data is radar generated data showing the air traffic, includes position, beacon code, altitude.

5.1 Outputs

- CORRELATED_TRACK_DATA - Track data that has been correlated with an appropriate flight plan.

5.2 Flight Plan Conformance Check

5.2 Description

The Flight Plan Conformance Check object passes through the necessary correlated track data.

5.2 Inputs

- CORRELATED_TRACK_DATA - Track data that has been correlated with an appropriate flight plan.

5.2 Outputs

- CORRELATED_TRACK_DATA - Track data that has been correlated with an appropriate flight plan.

5.2 Flight Plan Conformance Check Discussion

The 5.2 Flight Plan Conformance compares flight plan-aided aircraft progress to flight plan data and notes anomalies. The children of 5.2 Flight Plan Conformance Check are shown in Figure 39 on page 109.

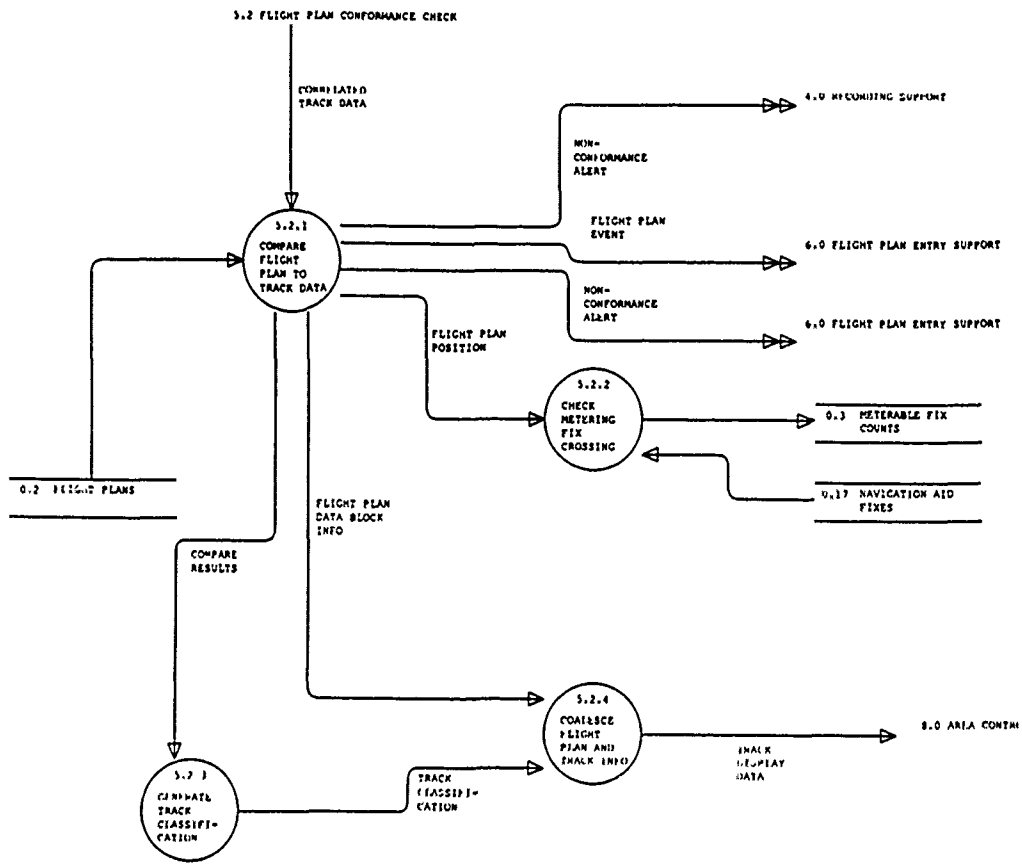


Figure 39. 5.2 Flight Plan Conformance Check. This figure is the data flow diagram for the IOM Object, 5.2 Flight Plan Conformance Check

5.2.1 Compare Flight Plan to Track Data

5.2.1 Description

The Compare Flight Plan to Track Data object examines each track with a correlated flight plan. For each identified flight plan, a window is drawn around the expected flight plan position and if the measured track is not within the window, a nonconformance report is issued. The results are passed to 5.1.3 Generate Track Classification and the corresponding data blocks are passed to 5.1.4 Coalesce Flight Plan.

5.2.1 Inputs

- CORRELATED_TRACK_DATA - Track data that has been correlated with an appropriate flight plan.

5.2.1 Outputs

- FLIGHT_PLAN_DATA-BLOCK_INFO - Flight plan information to be included on the surveillance display that corresponds to specific flight plans.
- FLIGHT_PLAN_EVENT - An event for a flight plan, such as when it crosses a metering fix.
- FLIGHT_PLAN_POSITION - Coordinate positions of an aircraft on a flight plan.
- COMPARE_RESULTS - Results of comparing a flight's path with its flight plan trajectory.
- NON-CONFORMANCE_ALERT - Alert to be recorded for failure of a flight to stay on its flight plan.

5.2.2 Check Metering Fix Crossing

5.2.2 Description

The Check Metering Fix Crossing object compares the position of the correlated track to known metering fixes and updates the Meterable Fix Counts data store if a fix is crossed.

5.2.2 Inputs

- FLIGHT_PLAN_POSITION - Coordinate positions of an aircraft on a flight plan.

5.2.2 Outputs

None.

5.2.3 Generate Track Classification

5.2.3 Description

The Generate Track Classification object examines the comparison results and classifies each track. This classification is passed on to the 8.0 Area Controller.

5.2.3 Inputs

- COMPARE_RESULTS - Results of comparing a flight's path with its flight plan trajectory.

5.2.3 Outputs

- TRACK_CLASSIFICATION - A Classification of an identified track, such as free (no flight plan association), flight plan aided, or coast.

5.2.4 Coalesce Flight Plan and Track Information

5.2.4 Description

The Coalesce Flight Plan and Track Information object collects the flight plan data block information for a particular track and coalesces it with the track classification for output to 8.0 Area Controller.

5.2.4 Inputs

- FLIGHT_PLAN_DATA-BLOCK_INFO - Flight plan information to be included on the surveillance display that corresponds to specific flight plans.
- TRACK_CLASSIFICATION - A Classification of an identified track, such as free (no flight plan association), flight plan aided, or coast.

5.2.4 Outputs

- TRACK_DISPLAY_DATA - Data about the identified tracks to be presented to the controller, including correlated flight plans and classification.

Section Supplement

This section provides summary reports on data employed and derived by the functional object 5.0 Aircraft and Track Management.

"All Data Flows" Report

The following report, generated from the Excelerator database, identifies all data flows for the Aircraft and Track Management object.

Name	Alternate Name	Short Descrip.	Last Modify Date
H0118	ALERT CLASSIFICATION	CLASSIFICATION OF THE ALERT AS WARNING, SERIOUS, CRITICAL.	900122
H0104	ALERT DATA	DATA DESCRIBING A CONFLICT BETWEEN AN AIRCRAFT AND ANOTHER AIRCRAFT OR AN AIRCRAFT AND THE GROUND.	900122
H0117	ALERT DISPLAY DATA	DATA SENT BY THE TACTICAL PREDICTION FUNCTION TO THE CONTROLLER TO NOTIFY OF IDENTIFIED CONFLICTS OR ALERTS.	900122
H0130	ANALYSIS LOG	DATA LOGGED BY THE 3.0 PREDICTION & ANALYSIS OBJECT AND ITS CHILDREN	900122
H0109	ANALYSIS RESULTS DISPLAY/RES REQ	RESULTS OF THE PREDICTION AND RESOLUTION OBJECT AND RESOLUTION REQUESTS FROM THE CONTROLLER	900122
H0113	CALCULATED RESOLUTION	RESOLUTIONS CALCULATED BY THE STRATEGIC RESOLUTION FUNCTION, IN RESPONSE TO CONTROLLER REQUEST FOR RESOLUTION.	900122
H0123	COMPARE RESULTS	RESULTS OF COMPARING A FLIGHT'S PATH WITH ITS FLIGHT PLAN TRAJECTORY	900122
H0112	CONFLICT SITUATION	POTENTIAL CONFLICTS UNCOVERED IN THE ANALYSIS OF FLIGHT PLAN DATA, INCLUDING FUTURE AIRCRAFT-TO-AIRCRAFT CONFLICTS.	891218
H0105	CONFLICT SITUATION DATA	DATA CONCERNING A PARTICULAR CONFLICT WHICH HAS BEEN IDENTIFIED	900119
H0103	CORRELATED TRACK DATA	TRACK DATA THAT HAS BEEN CORRELATED WITH AN APPROPRIATE FLIGHT PLAN	900122
H0114	DELAY REQUEST	REQUEST FROM CONTROLLER TO DELAY AN AIRCRAFT'S PROGRESS IN ORDER TO AVOID OVERCROWDING AT SPECIFIC PLACES.	900116
H0119	EVASIVE MANEUVERS	MANEUVERS GENERATED TO AVOID IMMINENT CONFLICT. COMPOSED OF TURNS, ACCELERATION/DECELERATIONS, ALTITUDE CHANGES.	900122
H0102	FLIGHT PLAN CHANGES	A flight plan whose status has changed. It may have been initiated, amended, or initalized (flight departed).	891218
H0111	FLIGHT PLAN CHANGES/CONFLICT SIT	CHANGES IN FLIGHT PLANS DUE TO STATE CHANGES. CONFLICT SITUATIONS RESULTING FROM STRATEGIC PREDICTION.	900122
H0122	FLIGHT PLAN DATA-BLOCK INFO	FLIGHT PLAN INFORMATION TO BE INCLUDED ON THE SURVEILLANCE DISPLAY THAT CORRESPONDS TO SPECIFIC FLIGHT PLANS.	900122
H0121	FLIGHT PLAN EVENT	AN EVENT FOR A FLIGHT PLAN, SUCH AS WHEN IT CROSSES A METERING FIX	900122
H0129	FLIGHT PLAN POSITION	COORDINATE POSITIONS OF AN AIRCRAFT ON A FLIGHT PLAN	900122
H0126	FP EVENT / STATUS	FLIGHT PLAN EVENT, SUCH AS FIX CROSSINGS, AND STATUS, SUCH AS NONCONFORMANCE REPORTS.	900122

Name	Alternate Name	Short Descrip.	Last Modify Date
H0120	NON-CONFORMANCE ALERT	ALERT TO TO BE RECORDED FOR FAILURE OF A FLIGHT TO STAY ON ITS FLIGHT PLAN	900122
H0127	NONCONFORMANCE ALERTS	ALERTS SENT TO RECORDING SUPPORT WHEN A FLIGHT IS OUT OF CONFORMANCE WITH ITS FLIGHT PLAN	891218
H0106	PREDICTED TRACK DATA	PREDICTED TRACK DATA IS PREDICTED POSITIONS OF KNOWN AIRCRAFT TRACKS BASED ON PREVIOUS TRACK HISTORY.	900122
H0115	RECONFORMANCE REQUEST	REQUEST FROM THE CONTROLLER FOR AID IN BRINGING A STRAYED FLIGHT BACK INTO CONFORMANCE WITH ITS FLIGHT PLAN.	900118
H0116	RESOLUTION REQUEST	REQUEST FROM THE CONTROLLER FOR AID, IN THE FORM OF POTENTIAL SOLUTIONS, IN RESOLVING AN IDENTIFIED CONFLICT.	900119
H0108	RESOLUTION REQUESTS	Requests from the controller for resolutions to near-term, but not immediate, problems (e.g. flight plan non conform).	891219
H0124	TRACK CLASSIFICATION	A CLASSIFICATION OF AN IDENTIFIED TRACK, SUCH AS FREE (NO FLIGHT PLAN ASSOC), FLIGHT PLAN AIDED, OR COAST.	900122
H0123	TRACK DISPLAY DATA	DISPLAY DATA CONTAINING FLIGHT DATA BLOCKS AND TRACK CLASSIFICIATIONS.	891218
H0125	TRACK DISPLAY DATA	DATA ABOUT THE IDENTIFIED TRACKS TO BE PRESENTED TO THE CONTROLLER, INCLUDING CORRELATED FLIGHT PLANS AND CLASSIFCTN	900122
H0101	TRAFFIC SURVEILLANCE DATA	Traffic Surveillance Data is radar generated data showing the air traffic, includes position, beacon code, altitude.	900111
H0110	WEATHER SURV INFO	WEATHER INFORMATION IN THE FORM OF RADAR DATA AND REPORTS ON PRESSURE, WINDS ALOFT, TEMPERATURE, ETC.	891219

"All Records and their Elements" Report

The following report, generated from the Excelerator database, identifies all the records and their elements for the Aircraft and Track Management object.

Name	=(ELE/REC Name)+	Definition
ALERT DATA	=	ALERT ID
	+	ALERT TYPE
	+	AIRCRAFT ID
	+	PREDICTED TRACK POSITION
	+	OTHER AIRCRAFT ID
	+	TIME BEFORE IMPACT
ALERT DISPLAY DATA	=	ALERT ID
	+	FLIGHT PLAN ID
	+	AIRCAFT POSITION DATA
	+	ALERT TYPE
	+	ALERT INFORMATION
ANALYSIS LOG	=	ALERT DATA
	+	CONFLICT SITUATION DATA
ANALYSIS RESULTS DISPLAY	=	ALERT DISPLAY DATA
	+	EVASIVE MANEUVERS
ANALYSIS RES & RESOLUTION REQ	=	ANALYSIS RESULTS DISPLAY
	+	RESOLUTION REQUEST
CALCULATED RESOLUTION	=	FLIGHT PLAN ID
	+	PROPOSED FLIGHT PLAN UPDATE
COMPARE RESULTS	=	FLIGHT PLAN ID
	+	TRACK COAST
	+	FREE TRACK
CONFLICT SITUATIONS		
CONFLICT SITUATION DATA	=	FLIGHT PLAN ID
	+	CONFLICT TYPE
	+	INVOLVED AIRCRAFT
	+	TIME BEFORE INCIDENT
CORRELATED TRACK DATA	=	TRACK ID ''
	+(	FLIGHT PLAN ID)
	+	FLIGHT POSITION
DELAY REQUEST	=	FLIGHT PLAN ID
	+	LENGTH OF DELAY
	+	METERING FIX
EVASIVE MANEUVERS	=	ALERT ID
	+	MANEUVER
FLIGHT PLAN DATA BLOCK INFO	=	TRACK ID
	+(	FLIGHT PLAN ID)
	+	SUMMARISED TRACK INFO

Name	=(SLE/REC Name)+ Definition
FLIGHT PLAN EVENT	= FLIGHT PLAN ID
	+(METER FIX CROSSING)
	+(HANDOFF)
	+(INITIATE TRACKING)
	+(TERMINATE FLIGHT)
FLIGHT PLAN POSITION	= FLIGHT POSITION
FLIGHT PLAN STATUS	= NONCONFORMANCE ALERT
FLIGHT POSITION	= LATITUDE
	+ LONGITUDE
	+(ALTITUDE)
	+(VELOCITY)
FP CHANGES & CONFLICT SITUATIONS	= FLIGHT PLAN CHANGES
	+ CONFLICT SITUATION DATA
FP EVENT / STATUS	= FLIGHT PLAN EVENT
	+ FLIGHT PLAN STATUS
MANEUVER	= COMMAND
	+ DIRECTION
	+ DURATION
	+ SPEED
	+ QUALIFIER
NONCONFORMANCE ALERT	= FLIGHT PLAN ID
	+ FLIGHT POSITION
POSITION DATA	
PREDICTED TRACK DATA	= TRACK DATA INSTANCE
RECONFORMANCE REQUEST	= FLIGHT PLAN ID
	+ CURRENT POSITION
RESOLUTION REQUEST	= FLIGHT PLAN ID
	+ CURRENT POSITION
	+ CONFLICT TYPE
SUMMARISED FLIGHT PLAN DATA	= FLIGHT ID
	=(AIRCRAFT TYPE)
	= AIRSPEED
	=(DESTINATION)
	= FLIGHT POSITION
	=(BEACON CODE)
SUMMARISED FLIGHT PLAN INFO	
SUMMARISED TRACK DATA	

Name	=(ELE/REC Name	)+ Definition
SUMMARISED TRACK INFO	=(AIRCRAFT ID	)
	+(AIRCRAFT TYPE	)
	+ VELOCITY	
	+ FLIGHT POSITION	
	+(DESTINATION	)
TRACK CLASSIFICATION		
TRACK DATA INSTANCE	= TIME STAMP	
	+ AIRCRAFT POSITION DATA	
TRACK DISPLAY DATA	= TRACK ID	
	+(FLIGHT PLAN ID	)
	+ TRACK CLASSIFICATION	
	+ SUMMARISED TRACK INFO	

"All Data Stores" Report

5.0 Aircraft and Track Management employs/derives the following globally defined data stores described in Appendix A of this document:

- AIRCRAFT_AND_ENVIRONMENT_DATA (employs)
- FLIGHT_PLANS (employs)
- METERABLE_FIX_COUNTS (derives).

6.0 Flight Plan Entry Support

Introduction

Flight Plan Entry Support is the single entry point in the system for all flight plans. Types of flight plans which may be entered into the system are new and bulk flight plans; flight plan amendments; up-route flight plans (for probe extension); flight plans received during handoff; and trial flight plans.

The FLIGHT PLAN ENTRY SUPPORT object will be introduced by four graphics, namely:

- The Flight Plan Entry Support View From
- The Flight Plan Entry Support Interfaces
- The Flight Plan Entry Support Functional Object Tree
- Flight Plan Entry Support.

6.0 Flight Plan Entry Support "View From"

Flight Plan Entry Support receives new flight plans, amendments, updates, trial flight plans, and handoffs from Area Control. Updates to the flight plans are received from Aircraft & Track Management. Data is stored in the appropriate flight plan database, and passed to Flight Plan Operations Support for further processing. Figure 40 on page 116 presents DOD AAS from the view of the Flight Plan Entry Support process.

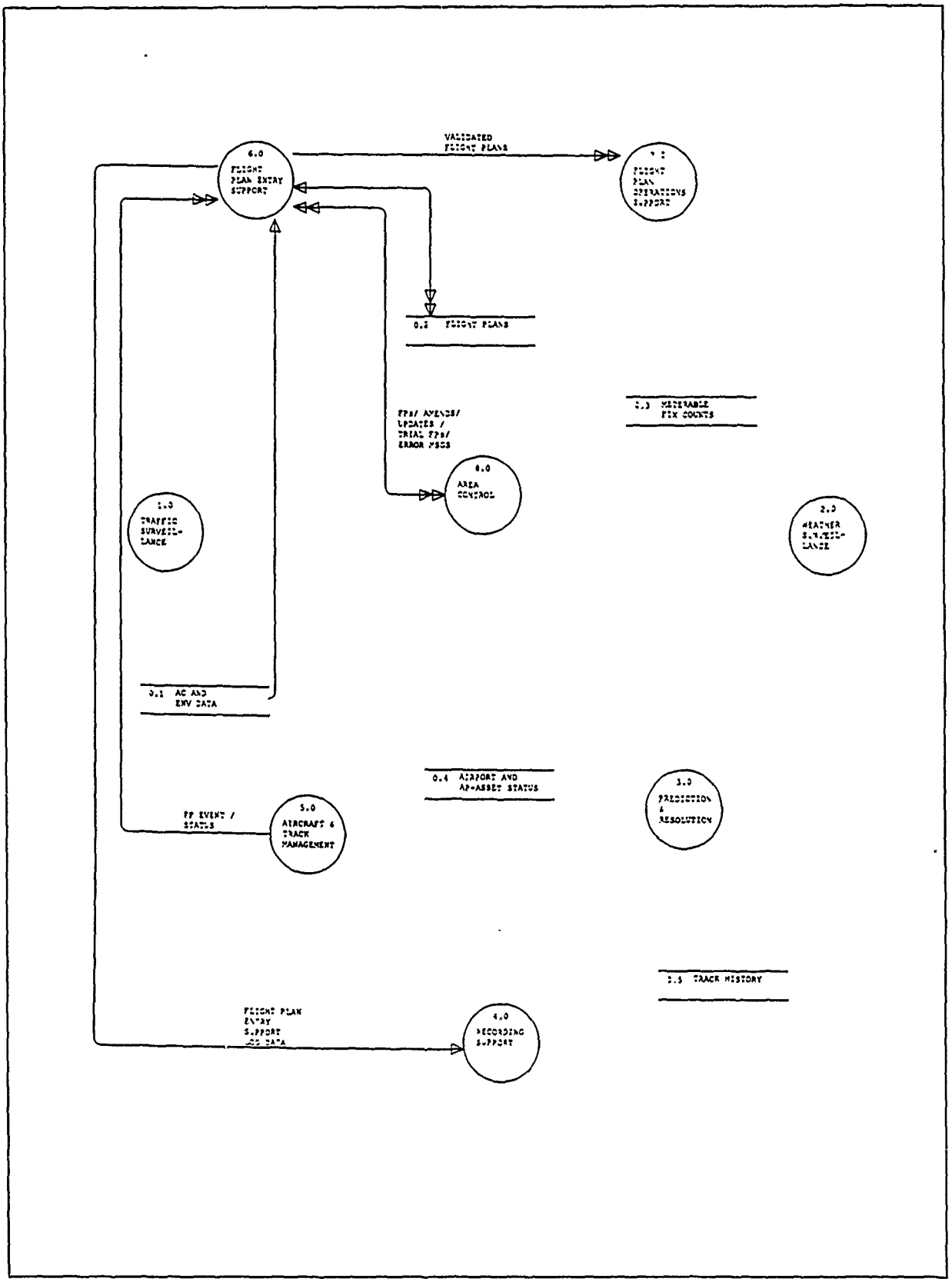


Figure 40. DoD AAS View From Flight Plan Entry Support. This figure highlights the Flight Plan Entry Support functional object and shows the flow of information to and from the other functional objects in the DoD AAS ATC Model.

6.0 Flight Plan Entry Support Interfaces

Figure 41 on page 118 shows the data flows used and generated by Flight Plan Entry Support. New flight plans, amendments, updates, trial flight plans, and handoffs are received from Area Control (within this center), as well as from neighboring Area Control Facilities, Tower Control Facilities, and the Flight Service Data Center within this center. Probe extension requests may also come from a neighboring Area Control Facility. Updates to the flight plans are received from Aircraft & Track Management.

Flight Plan Entry Support receives all the data mentioned above, and passes it to the appropriate function to be processed. The new flight plans and flight plan amendments are sent to Initial Flight Plan Processing. Initial Flight Plan Processing returns errors found during the processing of the flight plan data. Probe extension requests and trial flight plans are sent to Up-Route/Trial Flight Plan Processing. Flight plan updates are sent to Flight Plan Update Processing, and handoffs into the area are sent to Handoff-In Processing.

Once the flight plan data has been processed by Flight Plan Entry Support, it is passed to Flight Plan Operation Support.

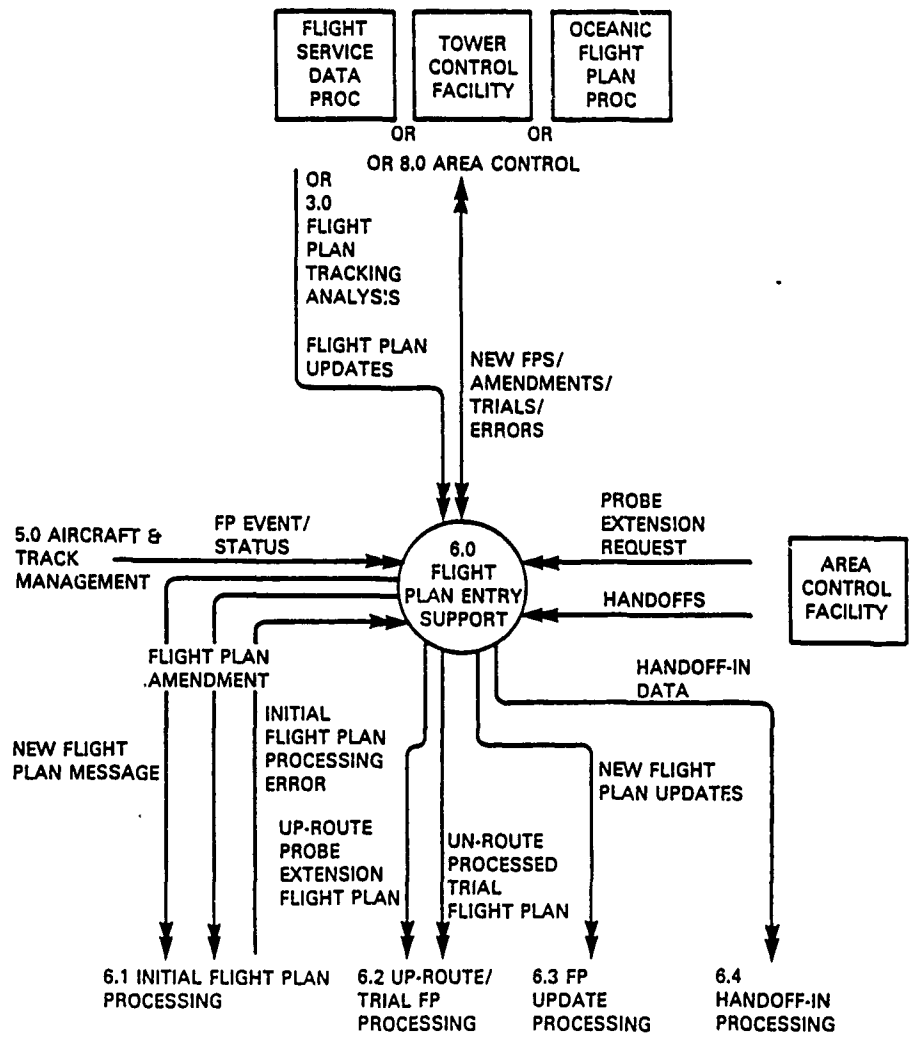


Figure 41. Flight Plan Entry Support Interfaces. This figure shows the interfaces with the Flight Plan Entry Support functional object, and the other functional objects of the DoD AAS ATC Model.

6.0 Inputs

- FPS_AMEND_UPDT_TRIAL_ERRORS - FP data sent to FLIGHT PLAN ENTRY SUPPORT. Includes new FPs, amendments, updates, trial FPs, and handoffs.
- FP_EVENT_STATUS - Updates to time fields in a flight plan. Sent from AIRCRAFT TRACK MANAGEMENT to FLIGHT PLAN ENTRY SUPPORT.
- PROBE_EXTENSION_REQUEST - Request for a probe extension for a specific flight plan. Received from an up-route center.
- HANDOFF-IN_DATA - Flight Plan from which handoff-in processing is required. Received from an up-route center and sent to HANDOFF-IN PROC.
- INITIAL_FP_PROC_ERRORS - Errors sent from INITIAL FP PROC to FP ENTRY SUPPORT which were detected during syntax or geography checking.

6.0 Outputs

- FPS_AMEND_UPDT_TRIAL_ERRORS - Errors sent to flight plan originator, in response to the FP data sent to FLIGHT PLAN ENTRY SUPPORT. Includes new FPs, amendments, updates, trial FPs, and handoffs.
- NEW_FLIGHT_PLAN_MESSAGE - New Flight Plan Message sent from FP ENTRY SUPPORT to INITIAL FP PROC. to be syntax/geography checked and stored.
- FLIGHT_PLAN_AMENDMENT - FP amendment sent from FP ENTRY SUPPORT to INITIAL FP PROC. to be syntax/geography checked and stored.
- UP-ROUTE_PROBE_EXTEN_FP - Flight Plan sent from FP ENTRY SUPPORT to UP-ROUTE/TRIAL FP PROC to be stored and sent to FP OPERATION SUPPORT.
- UN-ROUTE_PROC_TRIAL_FP - Trial FP sent from FP ENTRY SUPPORT to UP-ROUTE/TRIAL FP PROC to be stored and sent to FP OPERATION SUPPORT for route processing.
- NEW_FP_UPDATES - Flight Plan Updates sent from FP ENTRY SUPPORT to FP UPDATE PROC to be stored and sent to FP OPERATION SUPPORT.
- VALIDATED_FLIGHT_PLANS - FPs sent from FP ENTRY SUPPORT to FP OPERATION SUPPORT. FPs have been syntax and geographically checked. Need route processing.

6.0 Flight Plan Entry Support Functional Object Tree

The functional object tree identifies the communication paths between the functional objects in the Flight Plan Entry Support process. Figure 42 on page 121 shows the Functional Object Tree.

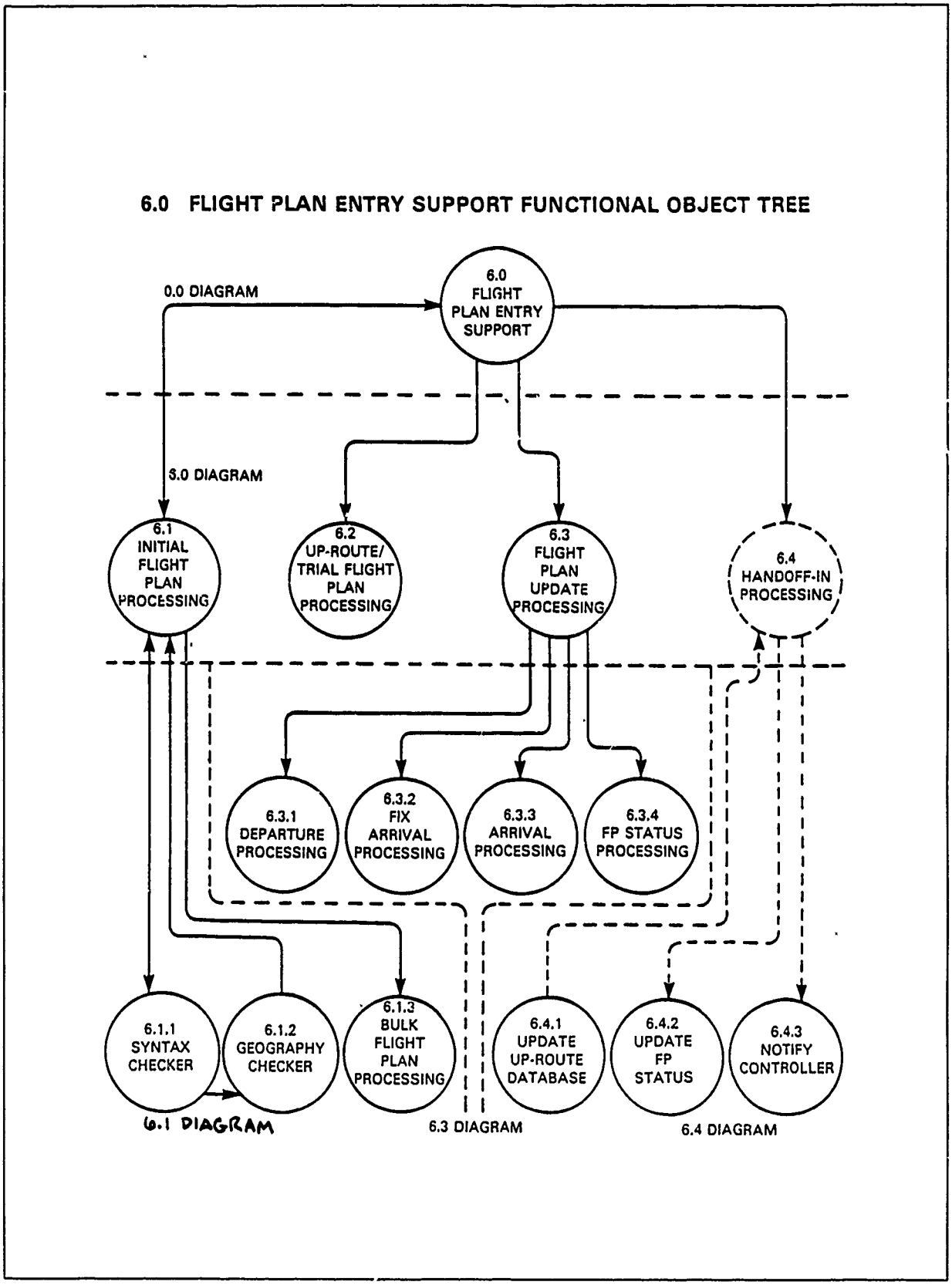


Figure 42. 6.0 Flight Plan Entry Support Functional Object Tree. This figure illustrates the functional object tree for the Flight Plan Entry Support Functional Object.

6.0 Flight Plan Entry Support Discussion

Flight Plan Entry Support will receive the flight plan message. If the input is a new or bulk flight plan, or if it is an amendment to a flight plan, Initial Flight Plan Processing is performed to verify the syntax of the message and to check the geographical data in the flight plan. Errors from this processing are passed back to Flight Plan Entry Support to be sent to the originator of the flight plan message. If the message is validated, Flight Plan Entry Support sends the flight plan to Flight Plan Operations Support for route validation and further processing.

If the input is an extended probe request from an up-route center, or a trial flight plan, Up-Route/Trial Flight Plan Processing is performed to store the flight plan in the appropriate database. The flight plan is then sent to Flight Plan Operation Support by Flight Plan Entry Support.

If the input is an update to a time in the flight plan, Flight Plan Update Processing is performed. The flight plan with the updated times are then sent to Flight Plan Operation Support by Flight Plan Entry Support.

If the input is a handoff from an up-route center, Handoff-In Processing is performed to notify the controller of the handoff, and put the flight plan into the system. Figure 43 on page 123 presents the processing controlled by Flight Plan Entry Support.

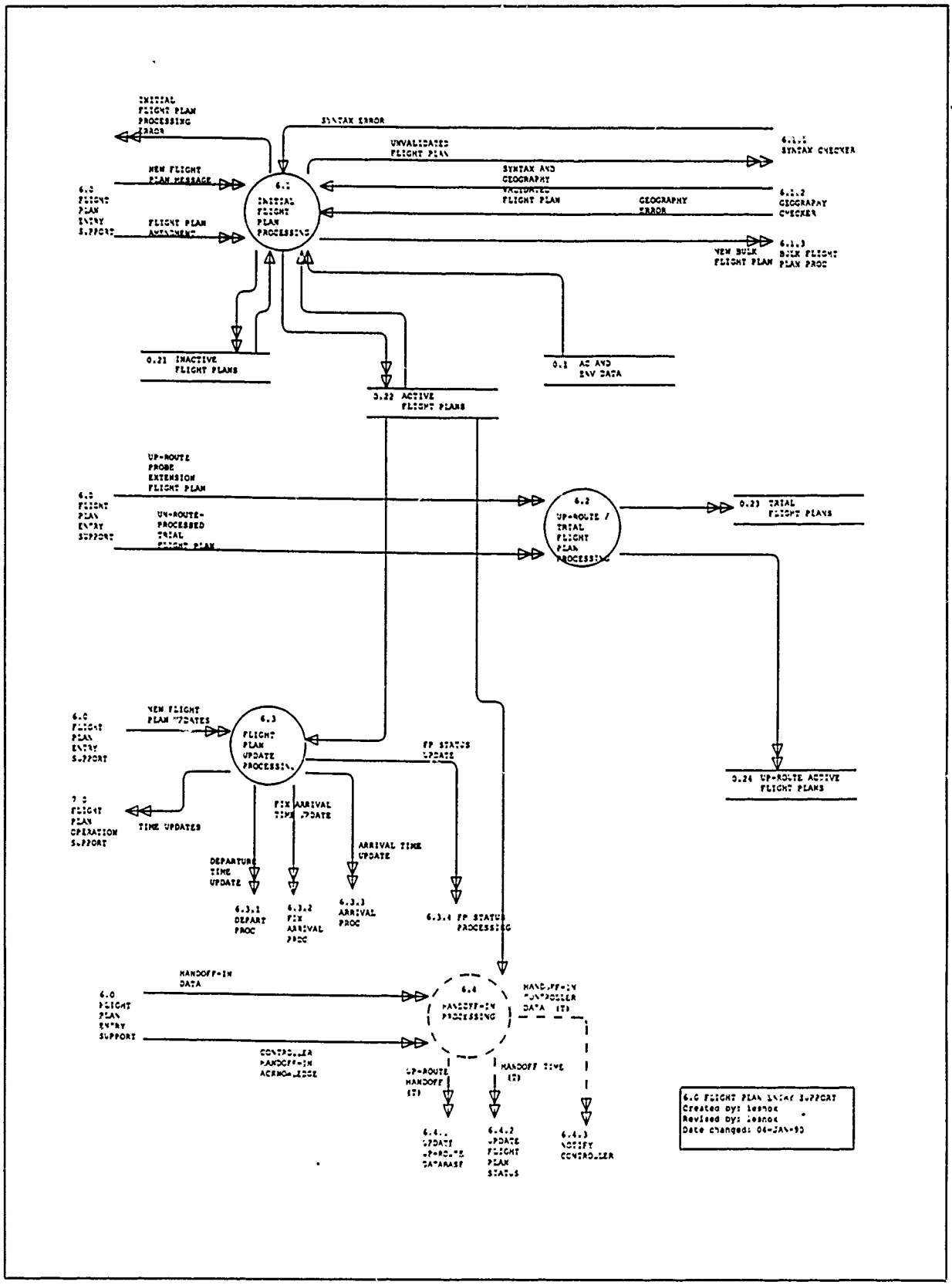


Figure 43. 6.0 Flight Plan Entry Support. This figure is the IOM object decomposition of the Flight Plan Entry Support Functional Object.

6.1 Initial Flight Plan Processing

6.1 Description

Initial flight Plan Processing processes new and bulk flight plans, as well as flight plan amendments. If the input is a flight plan amendment, a "new" flight plan is built.

Syntax Checker and Geography Checker are called to verify the syntax and geography data in the flight plan. If errors are detected, they are returned to Initial Flight Plan Processing, which sends the error message to Flight Plan Entry Support. If the flight plan is a bulk flight plan, after the message has been successfully checked, the flight plan is sent to Bulk Flight Plan Processing for further processing. The flight plan or amendment is stored in the appropriate database.

6.1 Inputs

- NEW_FLIGHT_PLAN_MESSAGE - New Flight Plan Message sent from FP ENTRY SUPPORT to INITIAL FP PROC. to be syntax/geography checked and stored.
- FLIGHT_PLAN_AMENDMENT - FP amendment sent from FP ENTRY SUPPORT to INITIAL FP PROC. to be syntax/geography checked and stored.
- SYNTAX_ERROR - Error found by SYNTAX CHECKER and sent to INITIAL FLIGHT PLAN PROC.
- GEOGRAPHY_ERROR - Error detected by GEOGRAPHY CHECKER and sent to INITIAL FP PROC.
- SYNTAX_GEOGRAPHY_VALIDATED_FP - Flight Plan which has been syntax and geographically checked. Sent from GEOGRAPHY CHECKER to INITIAL FP PROC.

6.1 Outputs

- INITIAL_FP_PROC_ERRORS - Errors sent from INITIAL FP PROC to FP ENTRY SUPPORT which were detected during syntax or geography checking.
- UN-VALIDATED_FLIGHT_PLAN - Flight Plan which has not been syntax or geographically checked. Sent from INITIAL FP PROC to SYNTAX Checker.
- NEW_BULK_FLIGHT_PLAN - New bulk flight plan, sent from INITIAL FP PROC to BULK FP PROC to be stored in the bulk flight plan database.

6.2 Up-Route / Trial Flight Plan Processing

Description

Up-Route / Trial Flight Plan Processing receives up-route and trial flight plans from Flight Plan Entry Support. This process updates the Up-Route Flight Plan Database with the Up-Route flight plans, and the Trial Flight Plan Database with the Trial Flight Plans.

6.2 Inputs

- UP-ROUTE_PROBE_EXTEN_FP - Flight Plan sent from FP ENTRY SUPPORT to UP-ROUTE/TRIAL FP PROC to be stored and sent to FP OPERATION SUPPORT.
- UN-ROUTE_PROC_TRIAL_FP - Trial FP sent from FP ENTRY SUPPORT to UP-ROUTE/TRIAL FP PROC to be stored and sent to FP OPERATION SUPPORT for route processing.

6.2 Outputs

- Flight Plans are stored in the appropriate database.

6.3 Flight Plan Update Processing

6.3 Description

Flight Plan Update Processing receives updates to times in a flight plan. If the update is a departure time, Departure Processing is called to update the time and move the flight plan from the Inactive Flight Plan Database to the Active Flight Plan Database. If the update is a fix arrival time, Fix Arrival Processing is called to modify the fix arrival time in the flight plan. If the update is a flight plan status update, Flight Plan Status Processing is called to modify the status in the flight plan. In each of the above cases, the updated Flight Plan is sent to Flight Plan Operation Support for further processing. Finally, if the update is an actual arrival time, Arrival Processing is called to remove the flight plan from the Active Flight Plan Database.

6.3 Inputs

- NEW_FP_UPDATES - Flight Plan Updates sent from FP ENTRY SUPPORT to FP UPDATE PROC to be stored and sent to FP OPERATION SUPPORT.

6.3 Outputs

- TIME_UPDATES - FP with an update to a time (departure, arrival, or arrival at a fix.) Sent from FP UPDATE PROC to FP OPERATION SUPPORT.
- DEPARTURE_TIME_UPDATE - Contains departure time for an FP. Sent from FP UPDATE PROC to DEPART PROC.
- FIX_ARRIVAL_TIME_UPDATE - Sent from FP UPDATE PROC to MODIFY TIMES. Contains actual arrival time at a fix in the flight plan.
- ARRIVAL_TIME_UPDATE - Actual arrival time for the flight plan. Sent from FLIGHT PLAN UPDATE PROCESSING to ARRIVAL PROC.
- FLIGHT_PLAN_STATUS_UPDATE - New status for an FP. Sent from FLIGHT PLAN UPDATE PROCESSING to FLIGHT PLAN STATUS PROCESSING to be updated in the ACTIVE FP database.

6.4 Handoff-In Processing

6.4 Description

When Handoff-In Processing receives a handoff-in message from an up-route center, or when it determines that a handoff within the center is required (ie. an the flight plan is an adapted time from crossing a sector boundary), it calls Notify Controller to notify the controller of the handoff. When the controller acknowledgement of the handoff is received, if the handoff was from an up-route center, Update Up-Route Database is called to delete the flight plan from the Up-Route Database. Update Flight Plan Status is called in any case, to update the handoff time in the flight plan. The update flight plan is then sent to Flight Plan Operation Support for further processing.

6.4 Inputs

- HANDOFF-IN_DATA - Flight Plan from which handoff-in processing is required. Received from an up-route center and sent to HANDOFF-IN PROC.
- CONTROLLER_HANDOFF_IN_ACK - Controller acknowledges the handoff-in. Sent from FP ENTRY SUPPORT to HANDOFF-IN PROCESSING>

6.4 Outputs

- UP-ROUTE_HANDOFF - Up-Route handoff flight plan sent from HANDOFF-IN PROC to UPDATE UP-ROUTE DATABASE to be deleted from the UP-ROUTE FP database and added to the ACTIVE FP database.
- HANDOFF_TIME - Time handoff occurred. Sent from HANDOFF-IN PROC to UPDATE FP STATUS to be updated in the ACTIVE FP database.
- HANDOFF-IN_CONTROLLER_DATA - Handoff-in data to be sent to the controller. Sent from HANDOFF-IN PROC to NOTIFY CONTROLLER.

6.1 Initial Flight Plan Processing Discussion

The new flight plan or flight plan amendment is first sent to Syntax Checker. If it contains no syntax errors, it is sent to Geography Checker. If it contains no geography errors, it is returned to Initial Flight Plan Processing to be stored in the appropriate flight plan database. Errors detected by these processes are also returned to Initial Flight Plan Processing.

Bulk flight plans are sent from Initial Flight Plan Processing to Bulk Flight Plan Processing to be stored in the flight plan database. Initial Flight Plan Processing also determines when a bulk flight plan must be activated, and sends it to Flight Plan Operation Support. Figure 44 on page 128 presents the processing controlled by Initial Flight Plan Processing.

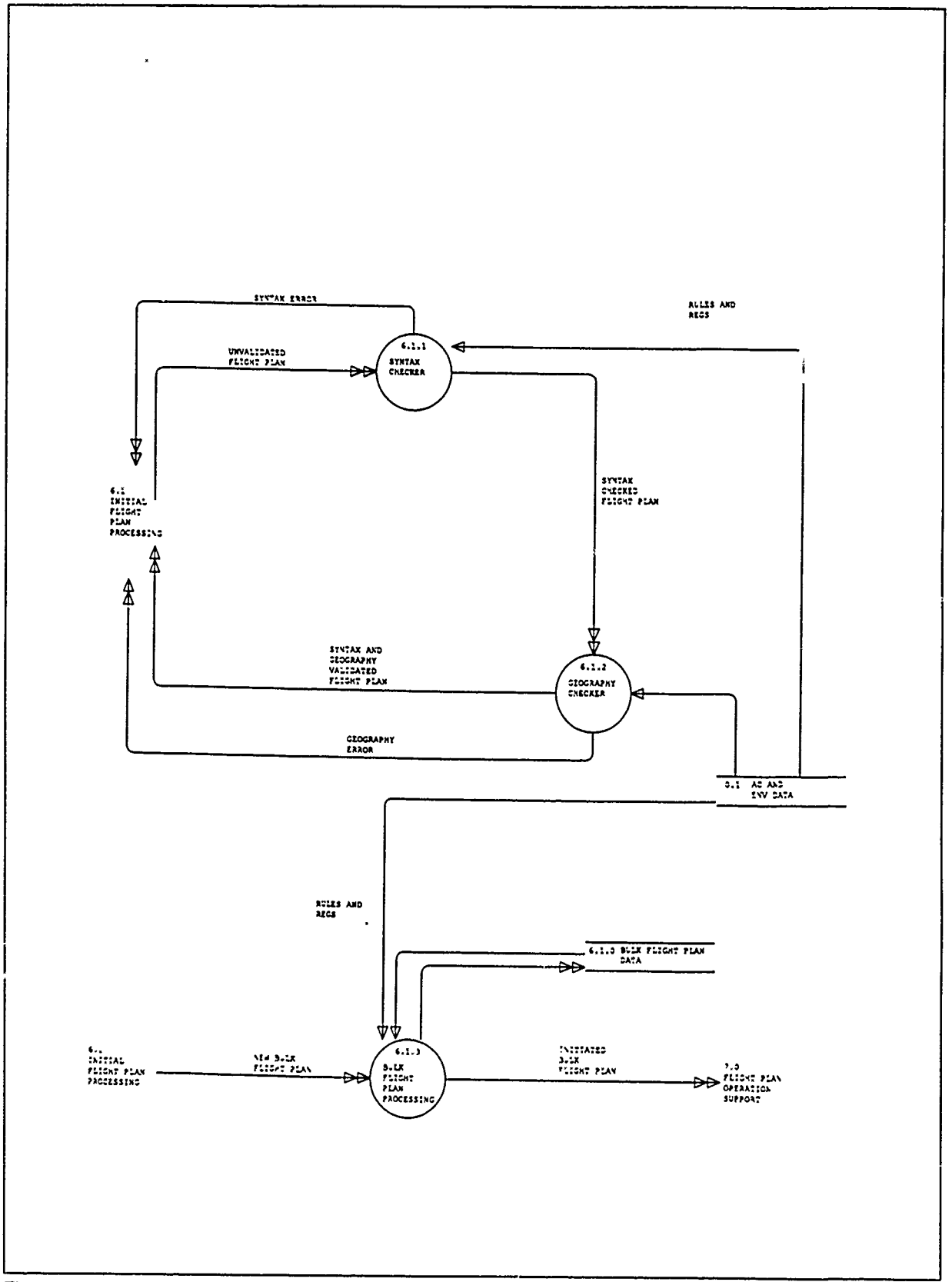


Figure 44. 6.1 Initial Flight Plan Processing DFD. This figure is the data flow diagram for the IOM Object, 6.1 Initial Flight Plan Processing

6.1.1 Syntax Checker

6.1.1 Description

Syntax Checker receives a flight plan message from Initial Flight Plan Processing and validates the syntax of the message. If an error is detected, an error message is sent to Initial Flight Plan Processing. Otherwise, the flight plan message is sent to Geography Checker.

6.1.1 Inputs

- UN-VALIDATED_FLIGHT_PLAN - Flight Plan which has not been syntax or geographically checked. Sent from INITIAL FP PROC to SYNTAX Checker.

6.1.1 Outputs

- SYNTAX_ERROR - Error found by SYNTAX CHECKER and sent to INITIAL FLIGHT PLAN PROC.
- SYNTAX_CHECKED_FP - FP which has been syntax checked by SYNTAX CHECKER and is being sent to GEOGRAPHY CHECKER to be checked geographically.

6.1.2 Geography Checker

6.1.2 Description

Geography Checker validates the geography in the flight plan message received from Syntax Checker. If the data is good, the flight plan message is returned to Initial Flight Plan Processing. Otherwise, an error message is sent returned.

6.1.2 Inputs

- SYNTAX_CHECKED_FP - FP which has been syntax checked by SYNTAX CHECKER and is being sent to GEOGRAPHY CHECKER to be checked geographically.

6.1.2 Outputs

- GEOGRAPHY_ERROR - Error detected by GEOGRAPHY CHECKER and sent to INITIAL FP PROC.
- SYNTAX_GEOGRAPHY_VALIDATED_FP - Flight Plan which has been syntax and geographically checked. Sent from GEOGRAPHY CHECKER to INITIAL FP PROC.

6.1.3 Bulk Flight Plan Processing

6.1.3 Description

Bulk Flight Plan Processing receives bulk flight plans from Initial Flight Plan Processing. The flight plans have already been through syntax and geography processing. The flight plans are stored in the Bulk Flight Plan Database until an adapted time prior to departure. At the adapted time, the flight plan is retrieved from the database and sent to Flight Plan Operation Support for further processing.

6.1.3 Inputs

- NEW_BULK_FLIGHT_PLAN - New bulk flight plan, sent from INITIAL FP PROC to BULK FP PROC to be stored in the bulk flight plan database.

6.1.3 Outputs

- INITIATED_BULK_FP - Bulk flight plan which is X minutes from departure. (X is an adapted value.) Sent from BULK FP PROC. to FP OPERATION SUPPORT for route processing.

6.3 Flight Plan Update Processing Discussion

When Flight Plan Update Processing receives a departure time, Departure Processing is called to update the time and move the flight plan from the Inactive Flight Plan Database to the Active Flight Plan Database. When Flight Plan Update Processing receives a fix arrival time update, Fix Arrival Processing is called to modify the fix arrival time in the flight plan. When Flight Plan Update Processing receives a flight plan status update, Flight Plan Status Processing is called to modify the status in the flight plan. When Flight Plan Update Processing receives an actual arrival time update, Arrival Processing is called to remove the flight plan from the Active Flight Plan Database. Figure 45 on page 132 presents the processing controlled by Flight Plan Update Processing.

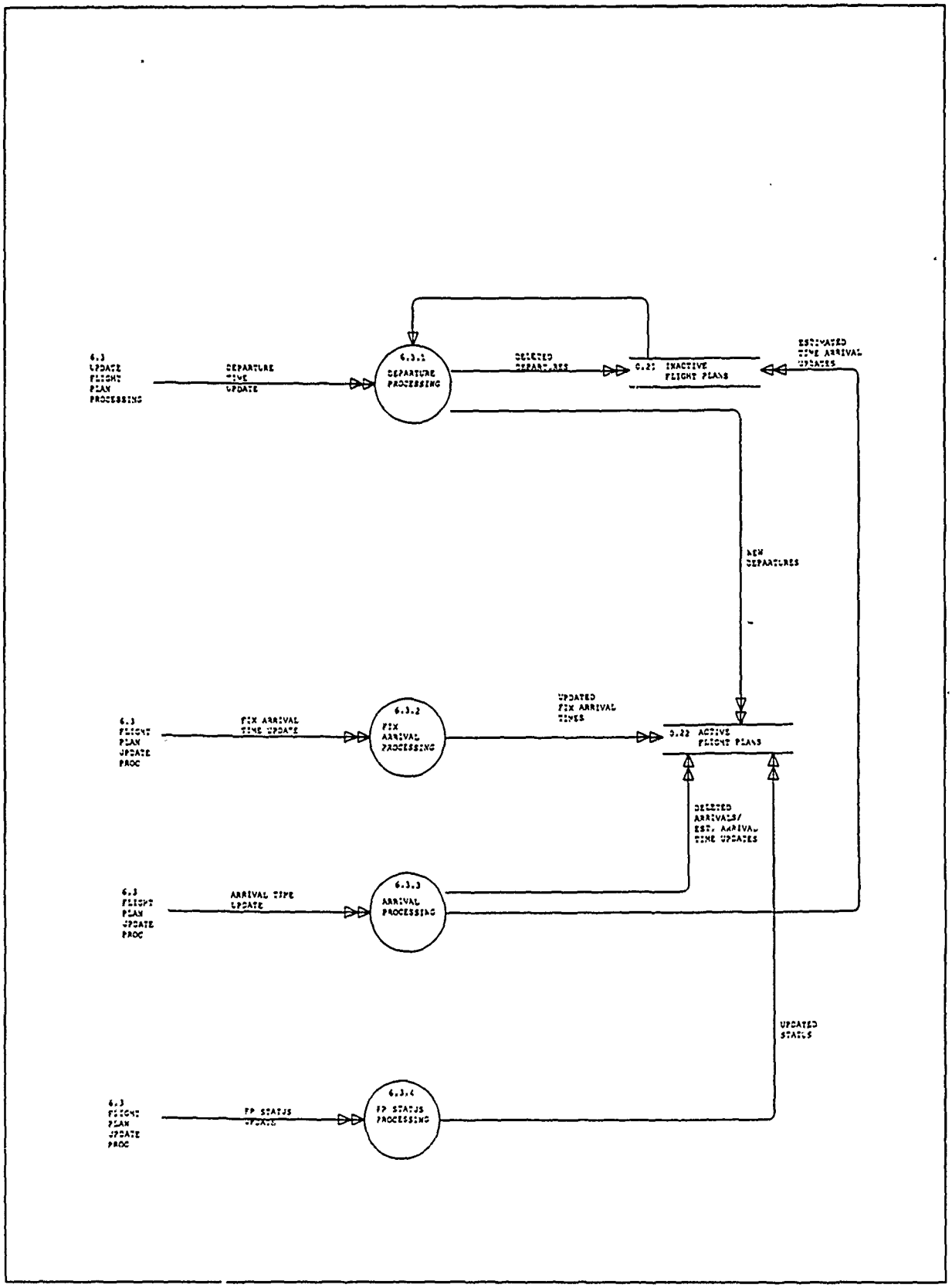


Figure 45. 6.3 Flight Plan Update Processing DFD. This figure is the DFD for the IOM Object, 6.3 Flight Plan Update Processing.

6.3.1 Departure Processing

6.3.1 Description

When Departure Processing receives an actual departure time from Flight Plan Update Processing, it retrieves the flight plan from the Inactive Flight Plan Database, updates the actual departure time in the flight plan, and stores the flight plan in the Active Flight Plan Database. If the update is to the estimated departure time, the time is updated in the Inactive Flight Plan Database.

6.3.1 Inputs

- DEPARTURE_TIME_UPDATE - Contains departure time for an FP. Sent from FP UPDATE PROC to DEPART PROC.

6.3.1 Outputs

- DELETED_DEPARTURES - FPs which have departed are deleted from the INACTIVE FP by DEPARTURE PROCESSING.
- NEW_DEPARTURES - Flight plans which have just departed. Stored in ACTIVE FP database by DEPARTURE PROCESSING.

6.3.2 Fix Arrival Processing

6.3.2 Description

When Fix Arrival Processing receives a flight plan time update from Flight Plan Update Processing, it updates the fix arrival time in the flight plan.

6.3.2 Inputs

- FIX_ARRIVAL_TIME_UPDATE - Sent from FP UPDATE PROC to MODIFY TIMES. Contains actual arrival time at a fix in the flight plan.

6.3.2 Outputs

- UPDATED_FIX_ARRIVAL_TIMES - Actual or estimated fix arrival time updates added to the ACTIVE FP database by MODIFY TIMES.

6.3.3 Arrival Processing

6.3.3 Description

When Arrival Processing receives an actual arrival time from Flight Plan Update Processing, it deletes the flight plan from the Active Flight Plan Database. If the update is to the estimated arrival time, the time is updated in the appropriate flight plan database. (The flight may be Active or Inactive.)

6.3.3 Inputs

- ARRIVAL_TIME_UPDATE - Actual arrival time for the flight plan. Sent from FLIGHT PLAN UPDATE PROCESSING to ARRIVAL PROC.

6.3.3 Outputs

- DELETED_ARRIVALS_ESTIMATED_ARRIVAL_TIME_UPDATE - Arrivals which are deleted from the ACTIVE FP database, or whose estimated time of arrival are modified in the ACTIVE FP database by ARRIVAL PROC.
- ESTIMATED_TIME_ARRIVAL_UPDATES - Estimated time of arrival updates to be made to the INACTIVE FP database by ARRIVAL PROC.

6.3.4 Flight Plan Status Processing

6.3.4 Description

When Flight Plan Status Processing receives an update to a flight plan status, it updates the status of the flight plan in the Active Flight Plan Database.

6.3.4 Inputs

- FLIGHT_PLAN_STATUS_UPDATE - New status for an FP. Sent from FLIGHT PLAN UPDATE PROCESSING to FLIGHT PLAN STATUS PROCESSING to be updated in the ACTIVE FP database.

6.3.4 Outputs

- UPDATED_STATUS - Status updates to an FP (FREE or FLAT).

6.4 Handoff-In Processing Discussion

Notify Controller is triggered when Handoff-In Processing receives a handoff-in message from an up-route center, or when it determines that a handoff within the center is required (ie. an the flight plan is an adapted time from crossing a sector boundary). Update Up-Route Database is triggered when the controller acknowledgement of the handoff is received by Handoff-In Processing, and the handoff was from an up-route center. Update Flight Plan Status is triggered to update the handoff time in the flight plan. The update flight plan is then sent to Flight Plan Operation Support for further processing. Figure 46 on page 136 presents the processing controlled by Handoff-In Processing.

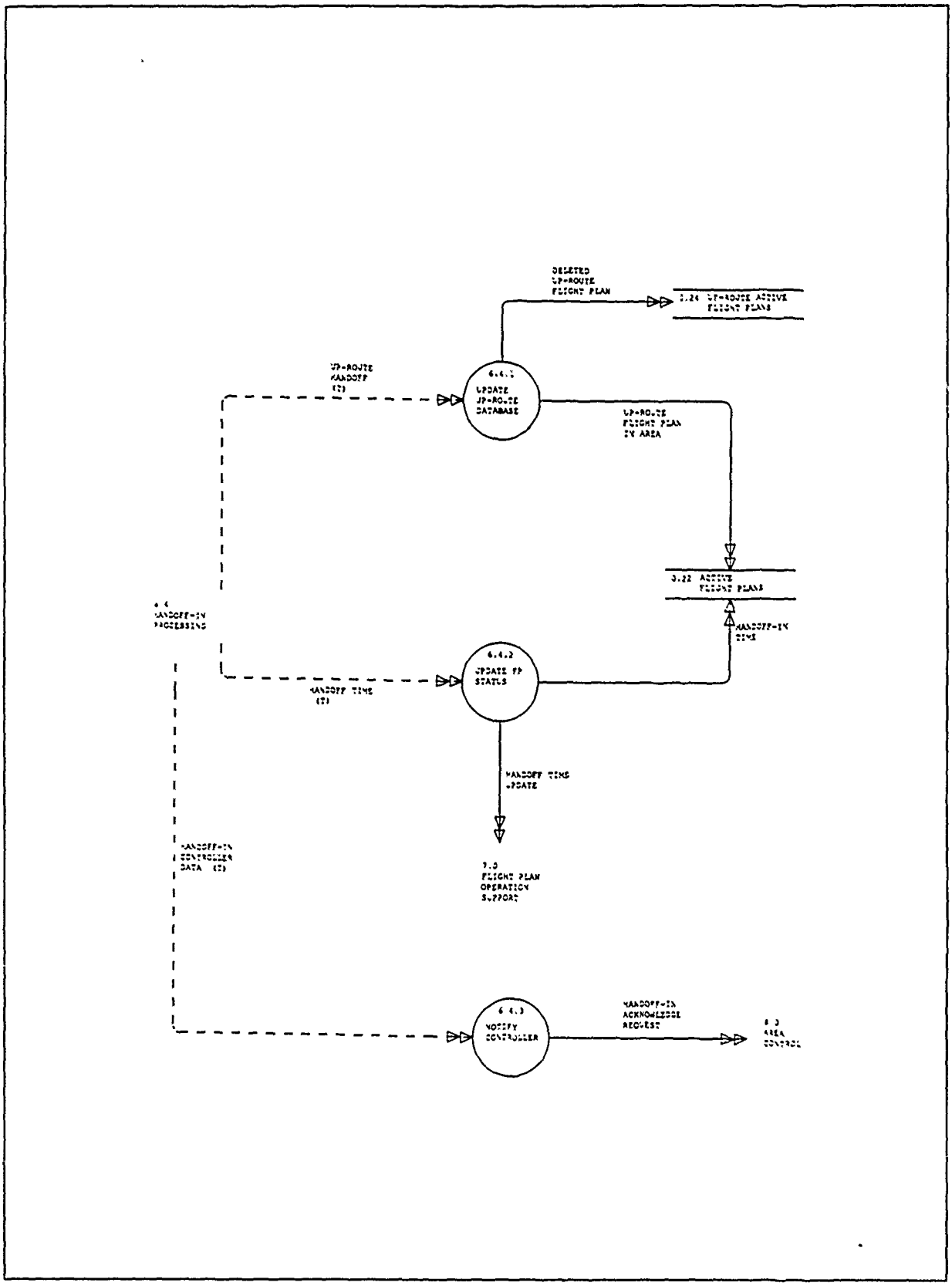


Figure 46. 6.4 Handoff-In Processing DFD. This figure is the data flow diagram for the IOM Object, 6.4 Handoff-In Processing.

6.4.1 Update Up-Route Database

6.4.1 Description

Update Up-Route Database is called when the controller acknowledges a handoff from an up-route center. If the flight plan is in the Up-Route Flight Plan Database, it is deleted from that database and moved to the Active Flight Plan Database.

6.4.1 Inputs

- UP-ROUTE_HANDOFF - Up-Route handoff flight plan sent from HANDOFF-IN PROC to UPDATE UP-ROUTE DATABASE to be deleted from the UP-ROUTE FP database and added to the ACTIVE FP database.

6.4.1 Outputs

- DELETED_UP-ROUTE_FP - FP to delete from UP-ROUTE FP database because it has moved into this area. Sent from UPDATE UP-ROUTE PROC.
- UP-ROUTE_FP_IN_AREA - UP-Route FP which has arrived in this area. Sent to ACTIVE FP database by UPDATE UP-ROUTE database.

6.4.2 Update Flight Plan Status

6.4.2 Description

Update Flight Plan Status is triggered when the controller acknowledges a handoff. The handoff time is updated in the Active Flight Plan Database. The updated time is then sent to Flight Plan Operation Support for further processing.

6.4.2 Inputs

- HANDOFF_TIME - Time handoff occurred. Sent from HANDOFF-IN PROC to UPDATE FP STATUS to be updated in the ACTIVE FP database.

6.4.2 Outputs

- HANDOFF-IN_TIME - Time that handoff into this area occurred. Updated in ACTIVE FP database by UPDATE FP STATUS.
- HANDOFF_TIME_UPDATE - Time of handoff-in. Sent from UPDATE FP STATUS to FP OPERATION SUPPORT for further processing.

6.4.3 Notify Controller

6.4.3 Description

Notify Controller is called when a handoff-in request is received from an up-route center, or when Handoff-In Processing detects that a flight plan is within and adapted time from crossing a sector. Notify Controller indicates to the controller the flight plan and its location.

6.4.3 Inputs

- HANDOFF-IN_CONTROLLER_DATA - Handoff-in data to be sent to the controller. Sent from HANDOFF-IN PROC to NOTIFY CONTROLLER.

6.4.3 Outputs

- HANDOFF-IN_ACK_REQUEST - Acknowledge request sent from NOTIFY CONTROLLER to AREA CONTROL to acknowledge a handoff-in.

When a handoff-in request is received, or when a flight plan is X minutes (X is an adapted value) from arrival into a sector in this area, Notify Controller is triggered. When the controller acknowledgement of the handoff is received by Handoff-In Processing, and the handoff was from an up-route center, Update Up-Route Database is triggered, followed by Update Flight Plan Status. When the controller acknowledgement of the handoff is received by Handoff-In Processing, and the handoff was from within the center, only Update Flight Plan Status is triggered. Figure 47 on page 140 presents the processing performed by Handoff-In Processing.

6.4 States

- KS001 - IDLE
  - IDLE
- KS002 - NOTIFYING_CONTROLLER
  - Notifying controller of a handoff-out.
- KS003 - PERFORMING DATABASE UPDATES
  - Removing the flight plan from the UP-ROUTE database and adding it to the ACTIVE database.
- KS004 - PERFORMING FLIGHT PLAN UPDATES
  - Updating the Handoff times in the flight plan.

6.4 Transition Vectors

- KTF02 - CONTROLLER NOTIFIED
  - CONDITION : CONTROLLER NOTIFIED
  - ACTION :
- KS004 - DATABASE_DONE_UPDATE_TIME
  - CONDITION : DATABASE UPDATES COMPLETE
  - ACTION : UPDATE HANDOFF TIME
- KTF03 - FP FROM UP-ROUTE AREA
  - CONDITION : FP FROM UP-ROUTE AREA, CONTROLLER HANDOFF-IN ACK
  - ACTIONS : DELETE FROM UP-ROUTE DATABASE, ADD TO ACTIVE FP DATABASE
- KS006 - HANDOFF_FROM_INSIDE_AREA
  - CONDITION : FP FROM INSIDE AREA, CONTROLLER HANDOFF-IN ACK
  - ACTION : UPDATE HANDOFF TIME
- KTF01 - HANDOFF_IN_RECEIVED
  - CONDITION : RECEIVED HANDOFF-IN REQUEST
  - ACTION : NOTIFY CONTROLLER
- KS005 - UPDATES COMPLETE
  - CONDITION : UPDATES COMPLETE
  - ACTION :

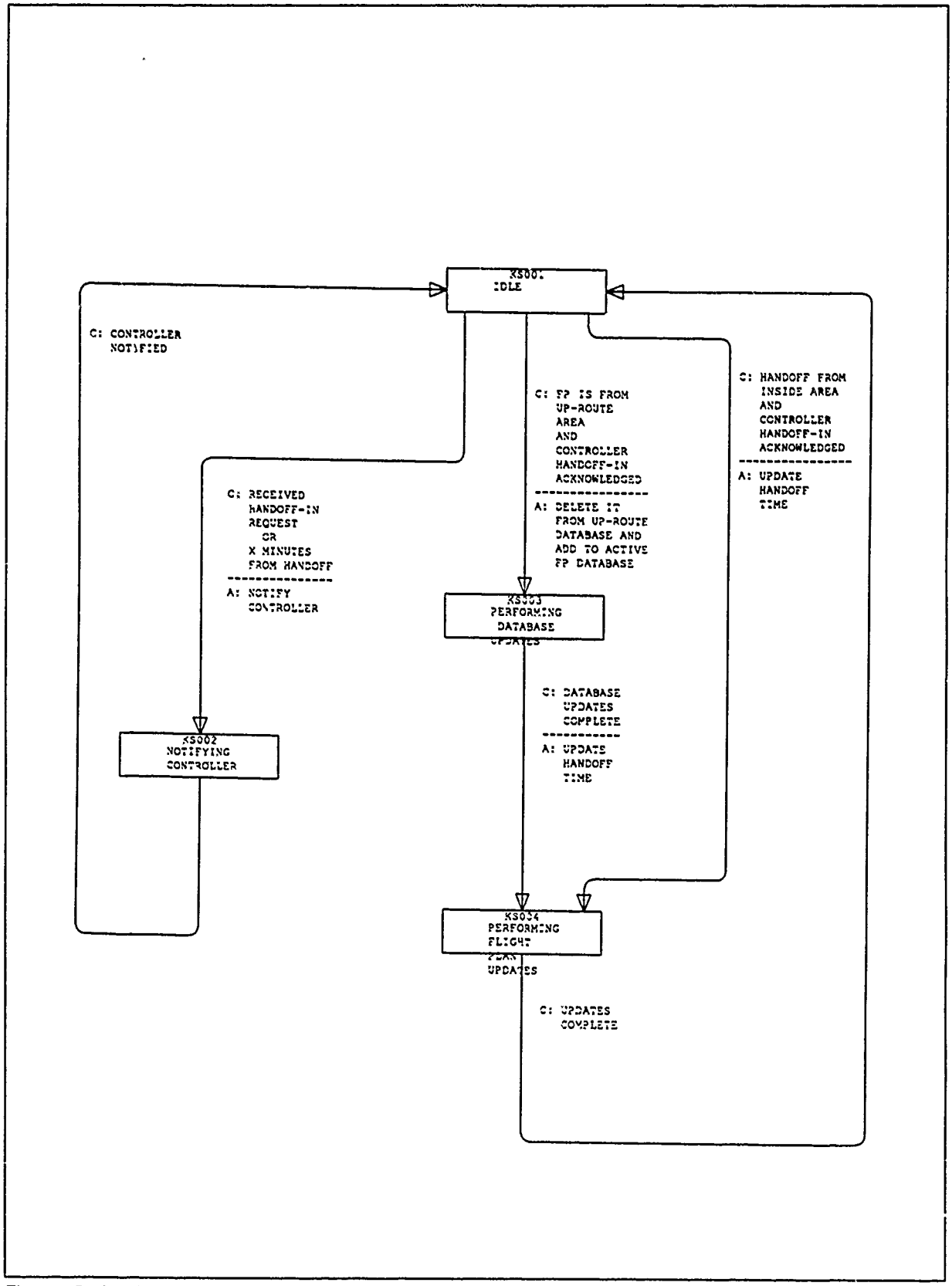


Figure 47. 6.4 Handoff-In Processing State Transition Diagram. This figure is the state transition diagram for the IOM Object, 6.4 Handoff-In Processing.

Section Supplement

This section provides summary reports on data employed and derived by the functional object 6.0 Flight Plan Entry Support.

"Flight Plan Entry Support" Information Flows

The following report identifies the inputs to and outputs from each of the functional objects in the Flight Plan Entry Support object.

PROCESS: 6.0 LABEL: FLIGHT PLAN ENTRYSUPPORT

INPUT	OUTPUT
***** The Following Data Flow is Two-Way *****	
DF FPS_AMEND_UPDT_TRIAL_ERRORS	*...
REC FPS_AMEND_UPDT_TRIAL_ERRORS	*...
R FLIGHT_PLAN	*...
R FLIGHT_PLAN_AMENDMENT	*...
R FLIGHT_PLAN_UPDATE	*...
R TRIAL_FLIGHT_PLAN	*...
R CONTROLLER_ACK_HANDOFF_ID	*...
R INITIAL_FP_PROC_ERRORS	*...
DF FP_EVENT_STATUS	
DF INITIAL_FP_PROC_ERRORS	
REC INITIAL_FP_PROC_ERRORS	
E SYNTAX_ERROR	
E GEOGRAPHY_ERROR	
DF PROBE_EXTENSION_REQUEST	
	DF VALIDATED_FLIGHT_PLANS
*...	. .REC FLIGHT_PLAN
*...	. . .E FLIGHT_PLAN_ID
*...	. . .R AIRCRAFT_DATA
*...	. . .R SPEED
*...	. . .E DEPARTURE_LOCATION
*...	. . .E ASSIGNED/REQUESTED_ALTITUDE
*...	. . .R ROUTE_DATA
*...	. . .E REMARKS
	DF NEW_FLIGHT_PLAN_MESSAGE
*...	. .REC FLIGHT_PLAN
*...	. . .E FLIGHT_PLAN_ID
*...	. . .R AIRCRAFT_DATA
*...	. . .R SPEED
*...	. . .E DEPARTURE_LOCATION
*...	. . .E ASSIGNED/REQUESTED_ALTITUDE
*...	. . .R ROUTE_DATA
*...	. . .E REMARKS
	DF FLIGHT_PLAN_AMENDMENT
*...	. .REC FLIGHT_PLAN_AMENDMENT
	DF UP-ROUTE_PROBE_EXTEN_FP
*...	. .REC FLIGHT_PLAN
*...	. . .E FLIGHT_PLAN_ID
*...	. . .R AIRCRAFT_DATA
*...	. . .R SPEED
*...	. . .E DEPARTURE_LOCATION
*...	. . .E ASSIGNED/REQUESTED_ALTITUDE
*...	. . .R ROUTE_DATA
*...	. . .E REMARKS
	DF UNROUTE_PROC_TRIAL_FP
*...	. .REC TRIAL_FLIGHT_PLAN
	DF NEW_FP_UPDATES
*...	. .REC FLIGHT_PLAN_UPDATE
*...	. . .E FLIGHT_PLAN_ID

*... Means Updated Data

CONTINUED FROM PREVIOUS PAGE

PROCESS: 6.0 LABEL: FLIGHT PLAN ENTRYSUPPORT

INPUT	OUTPUT
*.	. . .E DEPARTURE_TIME
*.	. . .E FIX_ARRIVAL_TIME
*.	. . .E ARRIVAL_TIME
*.	. . .E FLIGHT_PLAN_STATUS
	DF HANDOFF_IN_DATA
	REC HANDOFF_IN_DATA
	E FLIGHT_PLAN_ID
	R FLIGHT_LOCATION

*... Means Updated Data

GRAPH NAME: 6.0 FLIGHT PLAN ENTRY SUPPORT GRAPH FILE: L3RA0LH.TR3

PROCESS: 6.1 LABEL: INITIAL FLIGHT PLAN PROCESSING

INPUT	OUTPUT
DF GEOGRAPHY_ERROR	
ELE GEOGRAPHY_ERROR	. . . . . *
DF SYNTAX_ERROR	
ELE SYNTAX_ERROR.	. . . . . *
DF SYNTAX_GEOG_VALIDATED_FP	
REC FLIGHT_PLAN	. . . . . *
E FLIGHT_PLAN_ID	. . . . . *
R AIRCRAFT_DATA.	. . . . . *
R SPEED.	. . . . . *
E DEPARTURE_LOCATION	. . . . . *
E ASSIGNED/REQUESTED_ALTITUDE.	. . . . . *
R ROUTE_DATA	. . . . . *
E REMARKS.	. . . . . *
DF NEW_FLIGHT_PLAN_MESSAGE	
REC FLIGHT_PLAN	. . . . . *
E FLIGHT_PLAN_ID	. . . . .
R AIRCRAFT_DATA.	. . . . . *
R SPEED.	. . . . . *
E DEPARTURE_LOCATION	. . . . . *
E ASSIGNED/REQUESTED_ALTITUDE.	. . . . . *
R ROUTE_DATA	. . . . . *
E REMARKS.	. . . . . *
DF FLIGHT_PLAN_AMENDMENT	
REC FLIGHT_PLAN_AMENDMENT	
	DF NEW_BULK_FLIGHT_PLAN
	REC BULK_FLIGHT_PLAN
	DF UNVALIDATED_FLIGHT_PLAN
*.	. .REC FLIGHT_PLAN
*.	. . .E FLIGHT_PLAN_ID
*.	. . .R AIRCRAFT_DATA
*.	. . .R SPEED
*.	. . .E DEPARTURE_LOCATION
*.	. . .E ASSIGNED/REQUESTED_ALTITUDE
*.	. . .R ROUTE_DATA
*.	. . .E REMARKS
	DF INITIAL_FP_PROC_ERRORS
	REC INITIAL_FP_PROC_ERRORS
*.	. . .E SYNTAX_ERROR
*.	. . .E GEOGRAPHY_ERROR

*... Means Updated Data

GRAPH NAME: 6.0 FLIGHT PLAN ENTRY SUPPORT GRAPH FILE: LERAD_R.TRG

PROCESS: 6.2 LABEL: UP-ROUTE /TRIAL FLIGHT PLAN PROCESSING

INPUT	OUTPUT
DF UP-ROUTE_PROBE_EXTEN_FP	
REC FLIGHT_PLAN	
E FLIGHT_PLAN_ID	
R AIRCRAFT_DATA	
R SPEED	
E DEPARTURE_LOCATION	
E ASSIGNED/REQUESTED_ALTITUDE	
R ROUTE_DATA	
E REMARKS	
DF UNROUTE_PROC_TRIAL_FP	
REC TRIAL_FLIGHT_PLAN	

*... Means Updated Data

PROCESS: 6.3 LABEL: FLIGHT PLAN UPDATE PROCESSING

INPUT	OUTPUT
DF NEW_FP_UPDATES	
REC FLIGHT_PLAN_UPDATE	
E FLIGHT_PLAN_ID	. . . . . .*
E DEPARTURE_TIME	. . . . . .*
E FIX_ARRIVAL_TIME	. . . . . .*
E ARRIVAL_TIME	. . . . . .*
E FLIGHT_PLAN_STATUS	. . . . . .*
	DF DEPARTURE_TIME_UPDATE
	REC DEPARTURE_TIME_UPDATE
*.	. . .E FLIGHT_PLAN_ID
*.	. . .E DEPARTURE_TIME
	DF FIX_ARRIVAL_TIME_UPDATE
	REC FIX_ARRIVAL_TIME_UPDATE
*.	. . .E FLIGHT_PLAN_ID
*.	. . .E FIX_ARRIVAL_TIME
	DF TIME_UPDATES
	REC TIME_UPDATES
	R ARRIVAL_TIME_UPDATE
	R DEPARTURE_TIME_UPDATE
	R FIX_ARRIVAL_TIME_UPDATE
	R FLIGHT_PLAN_STATUS_UPDATE
	DF ARRIVAL_TIME_UPDATE
	REC ARRIVAL_TIME_UPDATE
*.	. . .E FLIGHT_PLAN_ID
*.	. . .E ARRIVAL_TIME
	DF FLIGHT_PLAN_STATUS_UPDATE
	REC FLIGHT_PLAN_STATUS_UPDATE
*.	. . .E FLIGHT_PLAN_ID
*.	. . .E FLIGHT_PLAN_STATUS

*... Means Updated Data

GRAPH NAME: 6.1 INITIAL FLIGHT PLAN PROC GRAPH FILE: _SB14MA.TRS

PROCESS: 6.1.1 LABEL: SYNTAX CHECKER

INPUT	OUTPUT
DF UNVALIDATED_FLIGHT_PLAN	
REC FLIGHT_PLAN	.*
E FLIGHT_PLAN_ID	.*
R AIRCRAFT_DATA	.*
R SPEED	.*
E DEPARTURE_LOCATION	.*
E ASSIGNED/REQUESTED_ALTITUDE	.*
R ROUTE_DATA	.*
E REMARKS	.*
DF RULES_AND_REGS	
	DF SYNTAX_ERROR
	ELE SYNTAX_ERROR
	DF SYNTAX_CHECKED_FP
*.	. .REC FLIGHT_PLAN
*.	. . .E FLIGHT_PLAN_ID
*.	. . .R AIRCRAFT_DATA
*.	. . .R SPEED
*.	. . .E DEPARTURE_LOCATION
*.	. . .E ASSIGNED/REQUESTED_ALTITUDE
*.	. . .R ROUTE_DATA
*.	. . .E REMARKS

*... Means Updated Data

PROCESS: 5.1.2 LABEL: GEOGRAPHY CHECKER

INPUT	OUTPUT
DF SYNTAX_CHECKED_FP	
REC FLIGHT_PLAN	. . . . .*
E FLIGHT_PLAN_ID	. . . . .*
R AIRCRAFT_DATA.	. . . . .*
R SPEED.	. . . . .*
E DEPARTURE_LOCATION	. . . . .*
E ASSIGNED/REQUESTED_ALTITUDE.	. . . . .*
R ROUTE_DATA	. . . . .*
E REMARKS.	. . . . .*
	DF GEOGRAPHY_ERROR
	E GEOGRAPHY_ERROR
	DF SYNTAX_GEOG_VALIDATED_FP
*.	. .REC FLIGHT_PLAN
*.	. . .E FLIGHT_PLAN_ID
*.	. . .R AIRCRAFT_DATA
*.	. . .R SPEED
*.	. . .E DEPARTURE_LOCATION
*.	. . .E ASSIGNED/REQUESTED_ALTITUDE
*.	. . .R ROUTE_DATA
*.	. . .E REMARKS

*... Means Updated Data

GRAPH NAME: 6.1 INITIAL FLIGHT PLAN PROC GRAPH FILE: LECTURE.TRS

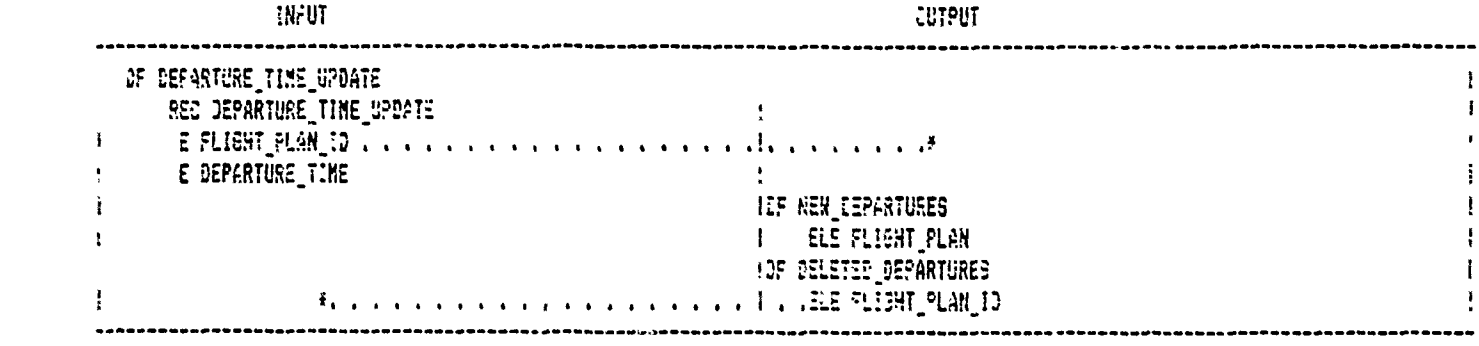
PROCESS: 6.1.2 LABEL: BULK FLIGHT PLAN PROCESSING

INPUT	OUTPUT
DF NEW_BULK_FLIGHT_PLAN REC BULK_FLIGHT_PLAN	
DF RULES_AND_REGS	
	DF INITIATED_BULK_FP REC FLIGHT_PLAN E FLIGHT_PLAN_ID R AIRCRAFT_DATA R SPEED E DEPARTURE_LOCATION E ASSIGNED/REQUESTED_ALTITUDE R ROUTE_DATA E REMARKS

*... Means Created Data

GRAPH NAME: 6.3 FLIGHT PLAN UPDATE PROC GRAPH FILE: LGRSINI.TRS

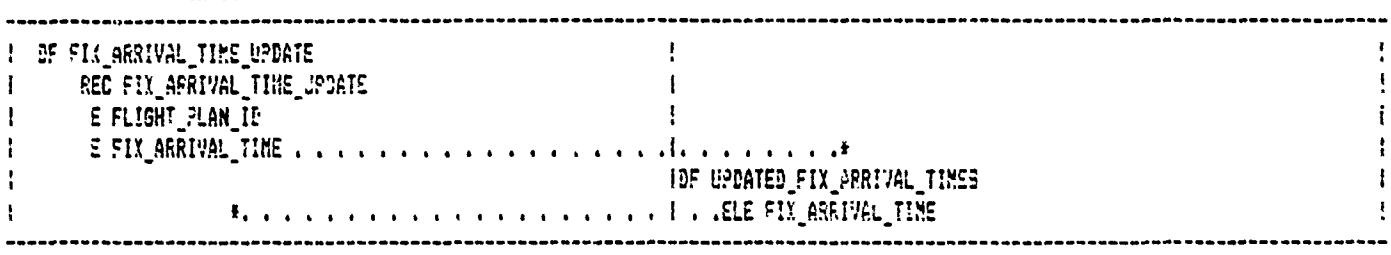
PROCESS: 6.3.1 LABEL: DEPARTURE PROCESSING



*... Means Updated Data

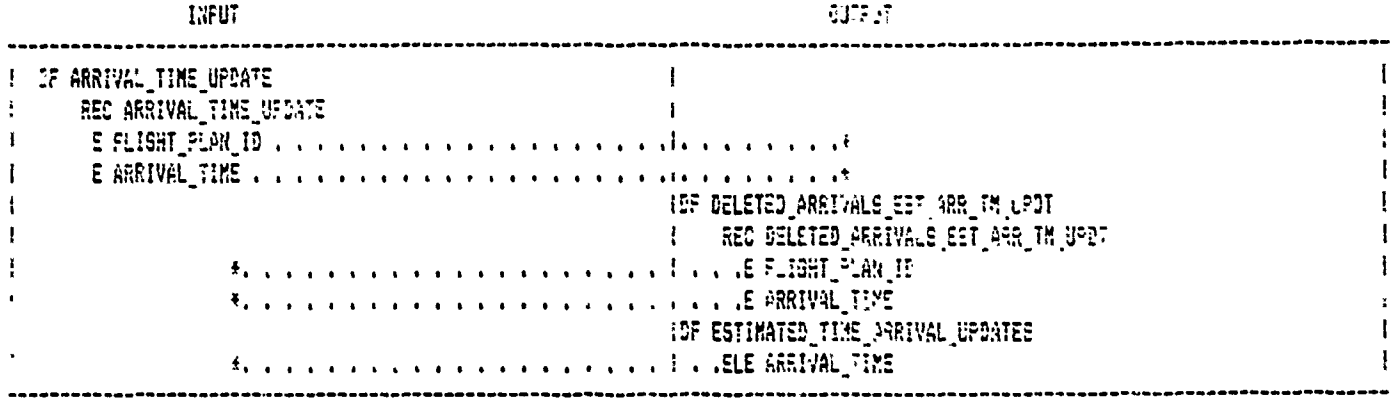
GRAPH NAME: 6.3 FLIGHT PLAN UPDATE PROC GRAPH FILE: LORGINI.TRG

PROCESS: 6.3.2 LABEL: FIX ARRIVAL PROCESSING



*... Means Updated Data

PROCESS: 6.3.3 LABEL: ARRIVAL PROCESSING



*... Means Updated Data

PROCESS: 6.3.4 LABEL: FP STATUS PROCESSING

INPUT	OUTPUT
DF FLIGHT_PLAN_STATUS_UPDATE	
REC FLIGHT_PLAN_STATUS_UPDATE	
E FLIGHT_PLAN_ID	
E FLIGHT_PLAN_STATUS	. . . . . *
	DF UPDATED_STATUS
*	. . ELE FLIGHT_PLAN_STATUS

*... Means Updated Data

APH NAME: 6.4 HANDOFF-IN PROCESSING GRAPH FILE: L6SSKGA.TRG

ROCESS: 6.4.1 LABEL: UPDATE UP-ROUTE DATABASE

INPUT	OUTPUT
	!DF SELETED_UPROUTE_FP
	! REC FLIGHT_PLAN_ID
	!DF UP_ROUTE_FP_IN_AREA
	! REC FLIGHT_PLAN
	! E FLIGHT_PLAN_ID
	! R AIRCRAFT_DATA
	! R SPEED
	! E DEPARTURE_LOCATION
	! E ASSIGNED/REQUESTED_ALTITUDE
	! R ROUTE_DATA
	! E REMARKS

#... Means Updated Data

PROCESS: 6.4.2 LABEL: UPDATE FP STATUS

INPUT	OUTPUT
	DF HANDOFF_TIME_UPDATE
	REC HANDOFF_TIME_UPDATE
	E FLIGHT_PLAN_ID
	E HANDOFF_IN_TIME
	DF HANDOFF_IN_TIME
	ELE HANDOFF_IN_TIME

*... Means Updated Data

GRAPH NAME: 6.4 HANDOFF-IN PROCESSING GRAPH FILE: LSESK3A.TRG

PROCESS: 6.4.3 LABEL: NOTIFY CONTROLLER

INPUT	OUTPUT
	!DF HANDOFF-IN_ACK_REQUEST
	REC HANDOFF-IN_ACK_REQUEST
	S FLIGHT_PLAN_ID
	R FLIGHT_LOCATION

*... Means Updated Data

"All Data Flows" Report

The following report, generated from the Excelerator database, identifies all data flows for the Flight Plan Entry Support object.

Name	Alternate Name	Short Descrip.	Last Modify Date
K0036	ARRIVAL TIME UPDATE	Actual arrival time for the flight plan. Sent from FP UPDATE PROC to ARRIVAL PROC.	900116
K0009	CONFLICT DATA	Flight Plans with updated conflict data. Logged in active FP database by Update Fix Data.	900110
K0062	CONFLICT SITUATIONS	Conflict situations received from FP TRACKING ANALYSIS. Sent to UPDATE FIX DATA to store with trajectory data.	891216
K0054	CONTROLLER ACK HANDOFF-OUT	Indication from FP OPER SUPP to FP STRIP/HANDOFF PROC that the controller acknowledged the handoff-out.	900105
K0059	CONTROLLER HANDOFF-OUT ACK	Ack sent from STRIP/HANDOFF to HANDOFF-OUT PROC to indicate controller acknowledged handoff-out.	900105
K0051	CONTROLLER HANDOFF IN ACK	Controller acknowledges the handoff-in. Sent from FP ENTRY PROC to HANDOFF-IN PROC.	900104
K0039	DELETED ARRIVALS EST ARR TM UPDT	Arrivals which are deleted from the ACTIVE FP database or whose ETA are updated by ARRIVAL PROC.	900116
K0040	DELETED DEPARTURES	FPs which have departed are deleted from the INACTIVE FP by DEPARTURE PROCESSING.	900104
K0043	DELETED UPROUTE FP	FP to delete from UP-Route FP database because it has moved into the area. Sent from UPDATE UPROUTE DATABASE.	900104
K0061	DELETE HANDOFF-OUT FP	Delete the fp that was handoff-out processed from the ACTIVE FP database for this area.	900105
K0032	DEPARTURE TIME UPDATE	Contains departure time for an FP. SEnt from FP UPDATE PROC to DEPART PROC.	900104
K0047	ESTIMATED TIME ARRIVAL UPDATES	Estimated time of arrival updates to be made to inactive flight plan database by ARRIVAL PROCESSING.	900111
K0033	FIX ARRIVAL TIME UPDATE	Sent from FP UPDATE PROC to MODIFY TIMES. Contains actual arrival time at a fix in the flight plan.	900104
K0028	FLIGHT PLAN AMENDMENT	FP amendment sent from FP ENTRY SUPPORT to INITIAL FP PROC. to be syntax/geog. checked and stored.	900104
K0049	FLIGHT PLAN CHANGES	Flight Plan with changes, sent from UPDATE FIX DATA to PREDICTION AND RESOLUTION for analysis of the changes.	900105
K0006	FLIGHT PLAN ENTRY LOG DATA	Data logged by FLIGHT PLAN ENTRY SUPPORT.	900104
K0005	FLIGHT PLAN OPERATION LOG DATA	Data logged by FLIGHT PLAN OPERATION SUPPORT.	900105
K0064	FLIGHT PLAN STATUS UPDATE	New status for an FP. Sent from FP UPDATE PROC to FP STATUS PROCESSING to be updated in the active FP database.	900116

Name	Alternate Name	Short Descrip.	Last Modify Date
K0004	FLIGHT PLAN STRIPS HANDOFF-OUT	Strips containing FP data. Sent from STRIP/HANDOFF to AREA CONT an adapted time prior to flight arr in that area/sector	900116
K0001	FPS AMEND UPDT TRIAL ERRORS	FP data sent to FLIGHT PLAN ENTRY SUPPORT. Includes new FPs, amendments, updates, trial FPs, & handoffs. Errors returned	900116
K0010	FP CHANGES CONFLICT SITUATIONS	Changes created to a flight plan which require PREDICTION & RESOLUTION to run, and the results of the run.	900105
K0003	FP EVENT STATUS	Flight Plan Event, such as fix crossings, and status, such as nonconformance reports.	900119
K0018	FP METERING DATA	Metering data for the FP, sent from GEN MET. TIMES to UPDATE FIX DATA so it can pass the data to the appro. place.	900105
K0017	FP NEEDING METERING	FP sent from UPDATE FIX DATA to GENERATE METERABLE TIMES for the purpose of calculating metering for its fixes.	900105
K0011	FP WITHOUT ROUTE DATA	Flight plan passed from FP OPERATION to EXPAND ROUTE for the purpose of completing the fixes in the route.	900105
K0015	FP WITHOUT TRAJECTORY	FP sent from UPDATE FIX DATA to CREATE TRAJECTORY for the purpose of filling in the trajectory data.	900105
K0006	FP WITH ROUTE DATA	Flight plan sent from EXPAND ROUTE to UPDATE FIX DATA.	900105
K0012	FP WITH TIME UPDATES	Flight plan which has had a time modified and requires a new trajectory and fix metering calculations.	900115
K0016	FP WITH TRAJECTORY DATA	FP sent from CREATE TRAJECTORY to UPDATE FIX DATA after the trajectory data has been provided.	900105
K0021	GEOGRAPHY ERROR	Error detected by GEOGRAPHY CHECKER and sent to INITIAL FP PROC.	900104
K0053	HANDOFF-IN ACK REQUEST	Acknowledge request sent from NOTIFY CONTROLLER to AREA CONTROL to acknowledge a handoff-in.	900104
K0056	HANDOFF-OUT INITIATED DATA	Data from INITIATE HANDOFF-OUT to STRIP/HANDOFF PROC to be sent to the controller.	900115
K0052	HANDOFF-OUT INIT REQUIRED	Indication from FP OPER SUPP to STRIP/HANDOFF PROC that it is time to initiate a handoff-out.	900105
K0055	HANDOFF-OUT NEEDED	STRIP/HANDOFF Proc initiates INITIATE HANDOFF with this indication that a handoff-out is needed.	900105
K0041	HANDOFF IN DATA	Flight plan for which handoff-in processing is required.	900104
K0045	HANDOFF IN TIME	Time that handoff into this area occurred. Updated in ACTIVE FP database by UPDATE FP STATUS.	900104

Name	Alternate Name	Short Descrip.	Last Modify Date
K0042	HANDOFF TIME UPDATE	Time of handoff-in. Sent from UPDATE FP STATUS to FP OPER SUPPORT for further processing.	900104
K0029	INITIAL FP PROC ERRORS	Errors sent from INITIAL FP PROC. to FP ENTRY SUPPORT which were detected during syntax or geography checking.	891215
K0019	INITIATED BULK FP	Bulk flight plan which is X min. from departure. Sent from BULK FP PROC. to FP OPERATION for route processing.	900104
K0020	NEW BULK FLIGHT PLAN	New bulk flight plan, sent from INITIAL FP PROC to BULK FP PROC to be stored in the bulk flight plan database.	900104
K0037	NEW DEPARTURES	Flight plans which have just departed. Stored in ACTIVE FP database by DEPARTURE PROCESSING.	900104
K0027	NEW FLIGHT PLAN MESSAGE	New flight plan message sent from FP ENTRY SUPPORT to INITIAL FP PROC. to be syntax/geog. checked and stored.	900104
K0048	NEW FPS AMENDS TRIALS ERRORS	FP data received from FLIGHT SERVICE DATA PROC, TOWER CONTROL FACILITY, OCEANIC FLIGHT PLAN PROC, or AREA CONTROL.	900103
K0034	NEW FP UPDATES	Flight plan updates sent from FP ENTRY SUPP to FP UPDATE PROC to be stored and sent to FP OPER SUPP.	900104
K0046	PROBE EXTENSION REQUEST	Request from an up-route center for a probe extension.	900119
K0007	ROUTE ERRORS	Errors in the route of a FP. Detected by EXPAND ROUTE. Sent to the originator of the flight plan.	900105
K0050	RULES AND REGS	Rules or regulations set up by the FAA headquarters, specifing limits within which the ATC is to function.	900119
K0058	STRIP DATA	Strip data sent from GEN STRIP to STRIP/HANDOFF PROC for distribution to the appropriate controller/area.	900105
K0057	STRIP NEEDED	Indication from STRIP/HANDOFF PROC to GEN STRIP that a strip is needed.	900105
K0013	STRIP REQUIRED	Indication from FP OPERATION to STRIP/HANDOFF PROCESSING that a strip is required.	900105
K0025	SYNTAX CHECKED FP	FP which has been syntax checked by SYNTAX CHECKER and is being sent to GEOG CHECKER to be checked geographically.	900104
K0022	SYNTAX ERROR	Error found by SYNTAX CHECKER and sent to INITIAL FLIGHT PLAN PROC.	900104
K0023	SYNTAX GEOG VALIDATED FP	Flight plan which has been syntax and geographically checked. Sent from GEOG CHECK to INITIAL FP PROC.	900104
K0035	TIME UPDATES	FP with an update to a time (departure, arrival, or arrival at a fix.) Sent from FP UPDATE PROC to FP OPER SUPP.	900104

Name	Alternate Name	Short Descrip.	Last Modify Date
K0031	UNROUTE PROC TRIAL FP	Trial FP sent from FP ENTRY SUPP to UP-ROUTE/TRIAL FP PROC to be stored and sent to FP OPER SUPP for route processing.	900104
K0024	UNVALIDATED FLIGHT PLAN	Flight Plan which has not been syntax or geographically checked. Sent from INITIAL FP PROC to SYNTAX CHECKER.	900104
K0039	UP-ROUTE PROBE EXTEN FP	Flight plan sent from FP ENTRY SUPP to UP-ROUTE/TRIAL FP PROC to be stored and sent to FP OPER SUPPORT.	900104
K0038	UPDATED FIX ARRIVAL TIMES	Actual or estimated fix arrival time updates added to the ACTIVE FP database by MODIFY TIMES.	900110
K0043	UPDATED STATUS	Status updates to an FP (FREE or FLAT).	900104
K0044	UP ROUTE FP IN AREA	Up-route FP which has arrived in this area. Sent to ACTIVE FP DATABASE by UPDATE FP STATUS.	900116
K0002	VALIDATED FLIGHT PLANS	FPs sent from FP ENTRY SUPP. to FP OPER. SUPP.. FPs have been syntax & geog. checked. Need route processing.	900116
K0026	WEATHER SURV INFO	Weather information in the form of radar data and reports on pressure, winds aloft, temperature, etc.	900119

"All Records and their Elements" Report

The following report, generated from the Excelerator database, identifies all the records and their elements for the Flight Plan Entry Support object.

Name	=(ELE/REC Name	)+ Definition
ARRIVAL TIME UPDATE	= FLIGHT PLAN ID ARRIVAL TIME	+ Update to the time of arrival in a flight plan.
CONTROLLER ACK HANDOFF OUT	= FLIGHT PLAN ID	Indicates flight plan for which handoff-out was acknowled
CONTROLLER HANDOFF IN ACK	= FLIGHT PLAN ID	Acknowledgement of handoff-in from AREA CONTROL.
DELETED ARRIVALS EST ARR TM UPDT	=(FLIGHT PLAN ID (ARRIVAL TIME	)+ FP id for arrivals to delete or est arrival time.)
DEPARTURE TIME UPDATE	= FLIGHT PLAN ID DEPARTURE TIME	+ Update to the departure time in a flight plan.
FIX ARRIVAL TIME UPDATE	= FLIGHT PLAN ID FIX ARRIVAL TIME	+ Update to a fix arrival time in a flight plan.
FLIGHT PLAN	= FLIGHT PLAN ID AIRCRAFT DATA SPEED DEPARTURE LOCATION ASSIGNED/REQUESTED ALTITUDE ROUTE DATA REMARKS	+ Entered prior to flight. Describes route, speed, alt. + + + + +
FLIGHT PLAN ENTRY LOG DATA	=(INITIAL FLIGHT PLAN PROC RESULTS (UP-ROUTE FLIGHT PLAN RECEIVED (TRIAL FLIGHT PLAN RECEIVED (FLIGHT PLAN UPDATE PROC RESULTS (HANDOFF-IN PROC RESULTS	)+ Data logged by FLIGHT PLAN ENTRY SUPPORT.)+)+)+)
FLIGHT PLAN METERING DATA	=(FIX ESTIMATED TIME OF ARRIVAL	+ List of fixes and estimated time of arrival.)
FLIGHT PLAN OPERATION LOG DATA	=(EXPAND ROUTE LOG (UPDATE FIX DATA LOG (STRIPS LOG (HANDOFF LOG	)+ Data logged during flight plan operations.)+)+)
FLIGHT PLAN STATUS UPDATE	= FLIGHT PLA. FLIGHT PLAN STATUS	+ Update to a flight plan status.
FLIGHT PLAN STRIPS HANDOFF-OUT	=(STRIP DATA (HANDOFF-OUT INITIATED DATA	)+ Info from STRIP/HANDOFF PROC to AREA CONTROLLER.)
FLIGHT PLAN UPDATE	= FLIGHT PLAN ID (DEPARTURE TIME (FIX ARRIVAL TIME (ARRIVAL TIME (FLIGHT PLAN STATUS	+ Update to a flight plan.)+)+)+)+

Name	=(ELE/REC Name	)+ Definition
FPS AMEND UPDT TRIAL ERRORS	=(FLIGHT PLAN	)+ FP data from AREA CNTL to FP ENTRY, & error msgs
	(FLIGHT PLAN AMENDMENT	)+
	(FLIGHT PLAN UPDATE	)+
	(TRIAL FLIGHT PLAN	)+
	(CONTROLLER ACK HANDOFF IN	)+
	(INITIAL FP PROC ERRORS	)
FP CHANGES CONFLICT SITUATIONS	=(FLIGHT PLAN	)+ Pipe from Flight Plan Operations to Prediction & Resol.
	(CONFLICT SITUATIONS	)
HANDOFF-IN ACK REQUEST	= FLIGHT PLAN ID	+ Request for controller to acknowledge handoff.
	FLIGHT LOCATION	
HANDOFF-OUT INITIATED DATA	= FLIGHT PLAN ID	+ Sent to controller to indicate a handoff-out needed.
	FLIGHT LOCATION	
HANDOFF-OUT INIT REQUIRED	= FLIGHT PLAN ID	+ Data to indicate which flight is to be handed out.
	FLIGHT LOCATION	
HANDOFF-OUT NEEDED	= FLIGHT PLAN ID	+ Indication to generate a handoff-out.
	FLIGHT LOCATION	
HANDOFF IN DATA	= FLIGHT PLAN ID	+ Flight Plan id and loc. for handoff flight.
	FLIGHT LOCATION	
HANDOFF TIME UPDATE	= FLIGHT PLAN ID	+ Handoff time to be updated in a flight plan.
	HANDOFF IN TIME	
INITIAL FP PROC ERRORS	=(SYNTAX ERROR	) Errors found in initial fp checking. Sent to AREA CNTL.
	(GEOGRAPHY ERROR	)
STRIP DATA		FP data printed at each sector in the flight plan.
TIME UPDATES	=(ARRIVAL TIME UPDATE	)+ Updates to any of the times or the status in a flight pl.
	(DEPARTURE TIME UPDATE	)+
	(FIX ARRIVAL TIME UPDATE	)+
	(FLIGHT PLAN STATUS UPDATE	)

Name	Definition
ARRIVAL_TIME	Time of arrival at the destination.
DEPARTURE_TIME	Time of departure.
ESTIMATED_TIME_OF_ARRIVAL	Estimated time of arrival at a fix or destination.
FIX	Unique location used for route determination in fps.
FIX_ARRIVAL_TIME	Arrival time at a specified fix.
FLIGHT_PLAN_ERROR_MESSAGE	Message sent to AREA CONTROL indicating error in fp.
FLIGHT_PLAN_ID	Uniquely defines a flight plan.
FLIGHT_PLAN_STATUS	Status of an active flight plan.
GEOGRAPHY_ERROR	Error found in GEOGRAPHY CHECKING.
HANDOFF-IN_TIME	
HANDOFF_IN_TIME	Time handoff into the sector/center occurred.
ROUTE_ERRORS	Errors detected during route processing.
SYNTAX_ERROR	Error found during SYNTAX CHECKING.

"All Data Stores" Report

6.0 Flight Plan Entry Support employs/derives the following globally defined data stores defined in Appendix A of this document:

- AIRCRAFT_AND_ENVIRONMENT_DATA(employs)
- FLIGHT_PLANS (employs/derives/updates).

"All Control Flows" Report

The following report, generated from the Excelerator database, identifies all control flows for the Flight Plan Entry Support object.

Name	Alternate Name	Short Descrip.	Last Modify Date
KCF03	HA `GFF-IN CONTROLLER DATA	Handoff-in data to be sent to the controller. Sent from HANDOFF-IN Proc to NOTIFY CONTROLLER.	891216
KCF02	HANDOFF TIME	Time handoff occurred. Sent from HANDOFF PROC to UPDATE FP Status to be updated in the active fp database.	891215
KCF01	UPROUTE HANDOFF	Up-route handoff fp sent from HANDOFF PROC to UPDATE UP-ROUTE DB to be deleted from upr. db, & added to act. db.	891215

Alternate Name	Long Description
HANDOFF-IN PROCESSING	HANDOFF-IN PROCESSING performs the following : - If input is handoff-in data, call NOTIFY CONTROLLER. - If input is controller acknowledgement of handoff, do : - If handoff is from an up-route area, triggers UPDATE UP-ROUTE database to delete it from the UP-ROUTE FP database and add it to the ACTIVE FP database. - Trigger UPDATE FP STATUS to update the handoff time in the fp and send the fp to FP OPER SUPP for further processing.

7.0 Flight Plan Operation Support

Introduction

Flight Plan Operation Support processes the flight plan data. It receives validated flight plans from Flight Plan Entry Support whenever a flight plan has been modified or added to the system. It expands the route in the flight plan, creates a trajectory for the flight, and generates the estimated time of arrival for meterable fixes in the route. Flight Plan Operation Support also scans the Active Flight Plan Database periodically to determine when a strip is required, or when a handoff out of the system is going to occur.

The FLIGHT PLAN OPERATIONS SUPPORT object will be introduced by four graphics, namely:

- The Flight Plan Operations Support View From
- The Flight Plan Operations Support Interfaces
- The Flight Plan Operations Support Functional Object Tree
- Flight Plan Operations Support.

7.0 Flight Plan Operation Support "View From"

Validated flight plans are received from Flight Plan Entry Support. After they have been processed, they are stored in the appropriate flight plan database (active or inactive), and also sent to Prediction and Resolution for further processing. Flight Plan Operations Support information is used by Flight Plan Operation Support when creating the trajectory. Handoffs and strip data are sent from Flight Plan Operation to Area Control. Figure 48 on page 147 presents DOD AAS from the view of the Flight Plan Operation Support process.

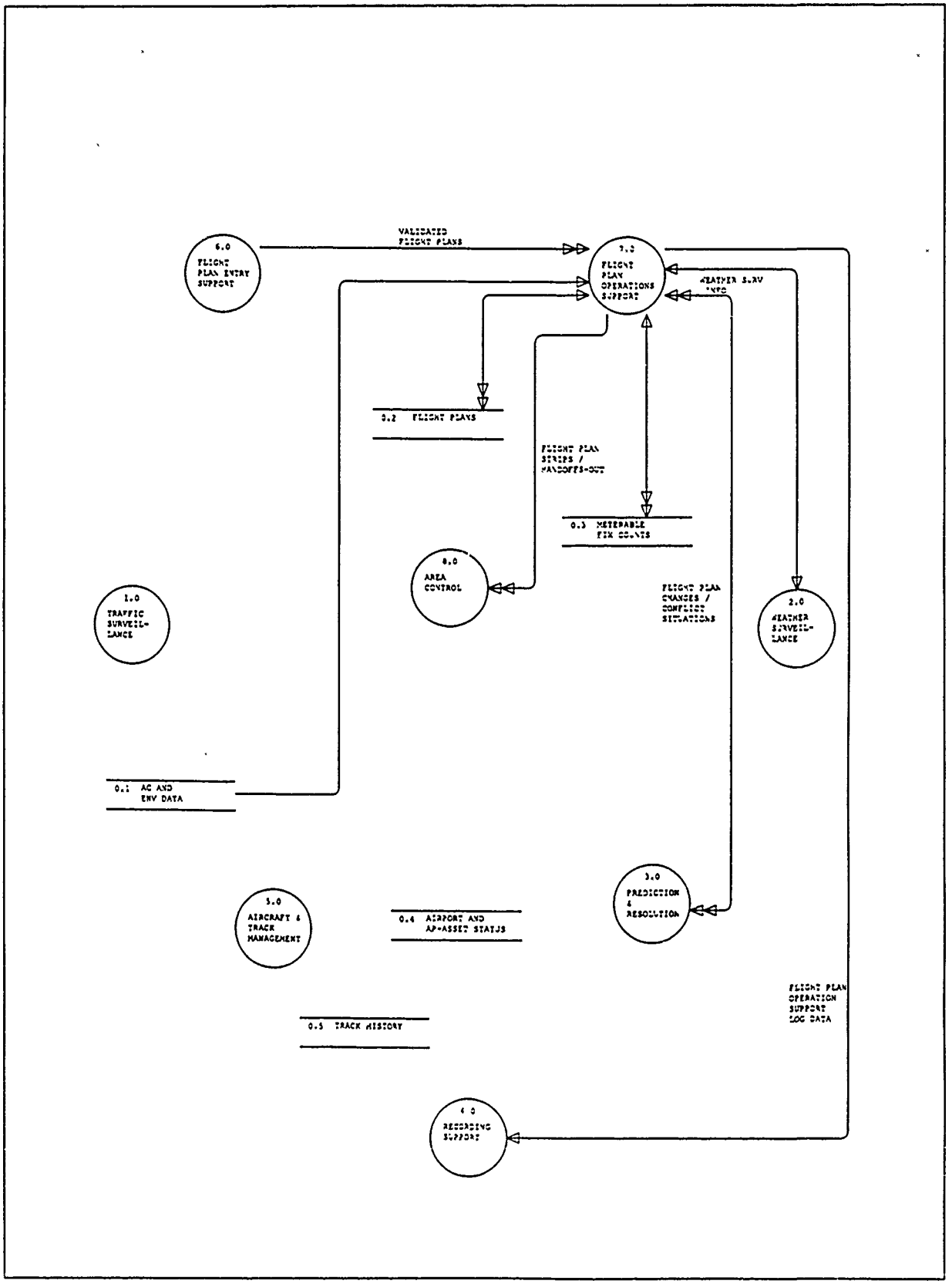


Figure 48. DoD AAS View From Flight Plan Operation Support. This figure highlights the Flight Plan Operation Support functional object and shows the flow of information to and from the other functional objects in the DoD AAS ATC Model.

7.0 Flight Plan Operation Support Interfaces

Flight Plan Operation Support receives validated flight plans (ie. syntax and geographic data have been verified) from Flight Plan Entry Support. Expand Route is called to expand the route data in the flight plan. If no errors in the route are found, Update Fix Data is called to create a trajectory and generate the estimated time of arrival for meterable fixes.

Flight Plan Operations Support also scans the Active Flight Plan Database periodically to determine any processing that is required. If a strip is required, Flight Plan Operations calls Strip/Handoff Processing to create the strip and send it to the appropriate controller. If a flight plan is within an adapted time from crossing a sector or center boundary, Strip/Handoff Processing is called to initiate the handoff. When the controller acknowledges the handoff, Flight Plan Operation Support calls Strip/Handoff Processing to process the acceptance. Figure 49 on page 149 shows the data flows used and generated by Flight Plan Operation Support.

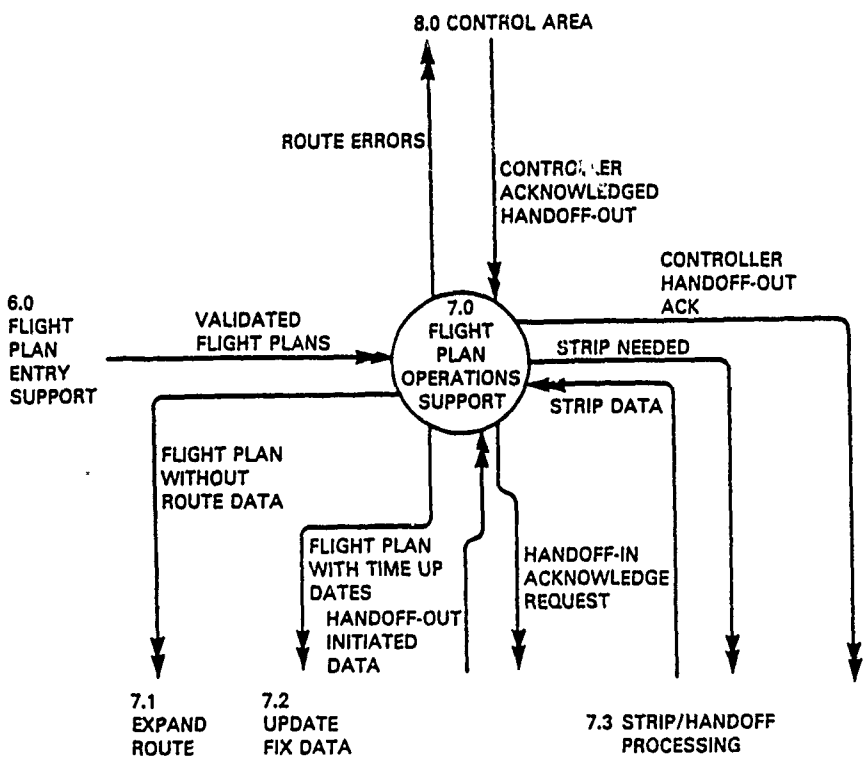


Figure 49. Flight Plan Operation Support Interfaces. This figure shows the interfaces with the Flight Plan Operation Support functional object, and the other functional objects of the DoD AAS ATC Model.

7.0 Inputs

- VALIDATED_FLIGHT_PLANS - Flight Plans sent from FP ENTRY SUPPORT to FP OPERATION SUPPORT. Flight plans have been syntax and geographically checked. They require route processing.
- CONTROLLER_ACK_HANDOFF-OUT - AREA CONTROL notifies FLIGHT PLAN OPERATION it acknowledges the handoff. FLIGHT PLAN OPERATION SUPPORT notifies FLIGHT PLAN STRIP/HANDOFF PROC that the controller acknowledged the handoff-out.

7.0 Outputs

- FP_WITHOUT_ROUTE_DATA - Flight Plan passed from FP OPERATION to EXPAND ROUTE for the purpose of completing the fixes in the route.
- FP_WITH_TIME_UPDATES - Flight Plan which has had a time modified and requires a new trajectory and fix metering calculations.
- HANDOFF-OUT_INIT_REQUIRED - Indication from FP OPERATION SUPPORT to STRIP/HANDOFF PROC that it is time to initiate a handoff-out.
- STRIP_REQUIRED - Indication from FP OPERATION SUPPORT to STRIP/HANDOFF PROCESSING that a strip is required.
- CONTROLLER_ACK_HANDOFF-OUT - AREA CONTROL notifies FLIGHT PLAN OPERATION it acknowledges the handoff. FLIGHT PLAN OPERATION SUPPORT notifies FLIGHT PLAN STRIP/HANDOFF PROC that the controller acknowledged the handoff-out.

7.0 Flight Plan Operation Support Functional Object Tree

The functional object tree identifies the communication paths between the functional objects in the Flight Plan Operation Support process. Figure 50 on page 152 shows the Functional Object Tree.

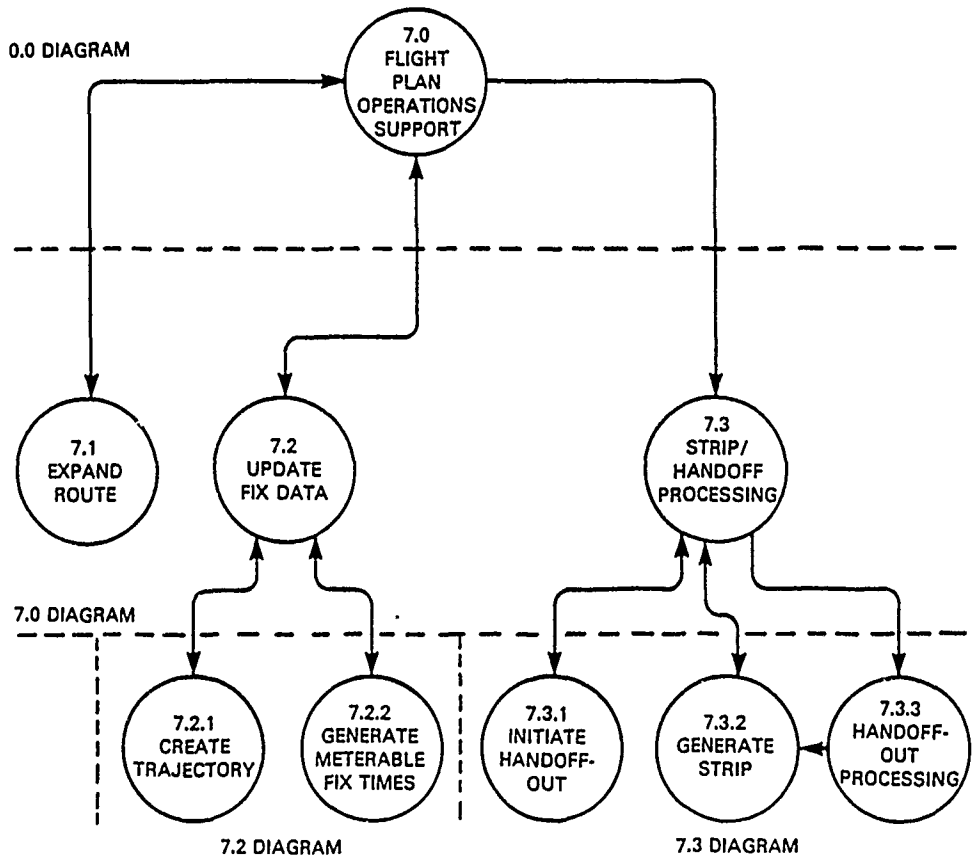


Figure 50. 7.0 Flight Plan Operation Support Functional Object Tree. This figure illustrates the functional object tree for the Flight Plan Operation Support Functional Object.

7.0 Flight Plan Operation Support Discussion

When Flight Plan Operation Support receives validated flight plans from Flight Plan Entry Support, Expand Route is called to expand the route data in the flight plan. If errors in the route are detected, they are sent to the controller. If no errors are found, Update Fix Data is called to create a trajectory and generate the estimated time of arrival for meterable fixes.

Flight Plan Operations Support also scans the Active Flight Plan Database periodically to determine any processing that is required. If a strip is required, Flight Plan Operation Support calls Strip/Handoff Processing to create the strip and send it to the appropriate controller. If a flight plan is within an adapted time from crossing a sector or center boundary, Strip/Handoff Processing is called to initiate the handoff. When the controller acknowledges the handoff, Flight Plan Operation Support calls Strip/Handoff Processing to process the acceptance. Figure 51 on page 154 presents the processing controlled by Flight Plan Operation Support.

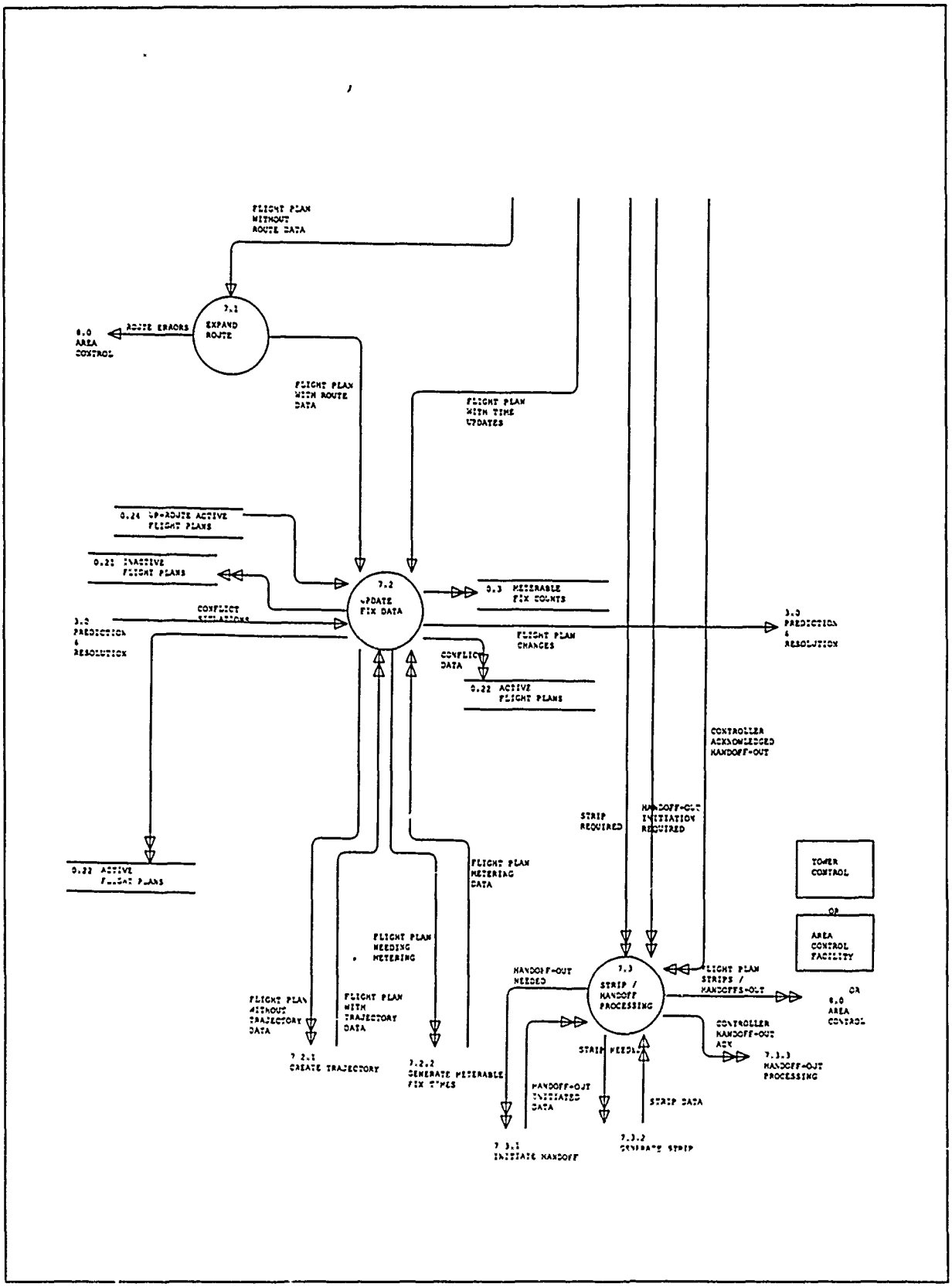


Figure 51. 7.0 Flight Plan Operation Support. This figure is the IOM object decomposition of the Flight Plan Operation Support Functional Object.

7.1 Expand Route

7.1 Description

Expand Route will generate all fixes along the route specified in the flight plan for this center. If there are errors, they are passed on to the controller. If no errors are found, the expanded flight plan is passed to Update Fix Data for further processing.

7.1 Inputs

- FP_WITHOUT_ROUTE_DATA - Flight Plan passed from FP OPERATION to EXPAND ROUTE for the purpose of completing the fixes in the route.

7.1 Outputs

- ROUTE_ERRORS - Errors in the route of a flight plan. Detected by EXPAND ROUTE. Sent to the originator of the flight plan.
- FP_WITH_ROUTE_DATA - Flight plan sent from EXPAND ROUTE to UPDATE FIX DATA. Contains expanded route.

7.2 Update Fix Data

7.2 Description

Update Fix Data will receive the flight plan data from Expand Route and Flight Plan Operation Support. Create Trajectory and Generate Meterable Fix Times are called to create the trajectory and generate the estimated time of arrival for meterable fixes. If the flight is active, the Meterable Fix Counts Database is updated with the meterable fix data. If conflict situation data is received from Prediction and Resolution, the data is stored in the appropriate database.

7.2 Inputs

- FP_WITH_TIME_UPDATES - Flight Plan which has had a time modified and requires a new trajectory and fix metering calculations.
- FP_WITH_ROUTE_DATA - Flight plan sent from EXPAND ROUTE to UPDATE FIX DATA. Contains expanded route.
- CONFLICT_SITUATIONS - Conflict data sent from PREDICTION & RESOLUTION to UPDATE FIX DATA to be stored in the appropriate FP database.
- FP_WITH_TRAJECTORY_DATA - FP sent from CREATE TRAJECTORY to UPDATE FIX DATA after the trajectory data has been provided.
- FP_METERING_DATA - Metering data for the FP, sent from GENERATE METERABLE FIX TIMES to UPDATE FIX DATA so it can pass the data to the appropriate place.

7.2 Outputs

- CONFLICT_DATA - Conflict data stored in the ACTIVE FP database by UPDATE_FIX_DATA.
- FLIGHT_PLAN_CHANGES - Flight Plan with changes, sent from UPDATE FIX DATA to PREDICTION AND RESOLUTION for analysis of the changes.
- FP_WITHOUT_TRAJECTORY_DATA - FP sent from UPDATE FIX DATA to CREATE TRAJECTORY for the purpose of filling in the trajectory data.

- FP_NEEDING_METERING - FP sent from UPDATE FIX DATA to GENERATE METERABLE TIMES for the purpose of calculating metering for its fixes.

7.3 Strip/Handoff Processing

7.3 Description

If a request for a strip is received by STRIP/HANDOFF PROCESSING, the strip data is generated and sent to the appropriate controller. If a handoff-out is required, Initiate Handoff-Out is called to generate the data to be sent to the controller or the down-route center for the handoff. When the controller acknowledges the handoff, Handoff-Out Processing is called to update the appropriate databases.

7.3 Inputs

- HANDOFF-OUT_INIT_REQUIRED - Indication from FP OPERATION SUPPORT to STRIP/HANDOFF PROC that it is time to initiate a handoff-out.
- STRIP_REQUIRED - Indication from FP OPERATION SUPPORT to STRIP/HANDOFF PROCESSING that a strip is required.
- CONTROLLER_ACK_HANDOFF-OUT - AREA CONTROL notifies FLIGHT PLAN OPERATION it acknowledges the handoff. FLIGHT PLAN OPERATION SUPPORT notifies FLIGHT PLAN STRIP/HANDOFF PROC that the controller acknowledged the handoff-out.
- HANDOFF-OUT_INITIATED_DATA - Data from INITIATE HANDOFF-OUT to STRIP/HANDOFF PROC to be sent to the controller.
- STRIP_DATA - Strip data sent from GENERATE STRIP to STRIP/HANDOFF PROC for distribution to the appropriate controller/area.

7.3 Outputs

- HANDOFF-OUT_NEEDED -STRIP/HANDOFF PROC initiates INITIATE HANDOFF with this indication that a handoff-out is needed.
- STRIP_NEEDED - Indication from STRIP/HANDOFF PROC to GENERATE STRIP that a strip is needed.
- CONTROLLER_HANDOFF-OUT_ACK - Acknowledgement sent from STRIP/HANDOFF PROC to HANDOFF-OUT PROC to indicate the controller acknowledged a handoff-out.
- FLIGHT_PLAN_STRIPS_HANDOFF-OUT - Strips containing Flight Plan data. Sent from STRIP/HANDOFF PROC to AREA CONTROLLER at an adapted time prior to flight arrival in that area/sector.

7.2 Update Fix Data Discussion

When Update Fix Data receives the flight plan data from Expand Route or Flight Plan Operation Support, it calls Create Trajectory to create the trajectory for the flight. Create Trajectory uses the current weather data along with the aircraft characteristics to create the trajectory. Update Fix Data also calls Generate Meterable Fix Times to generate the estimated time of arrival at the meterable fixes in the route. Figure 52 on page 158 presents the processing controlled by Update Fix Data.

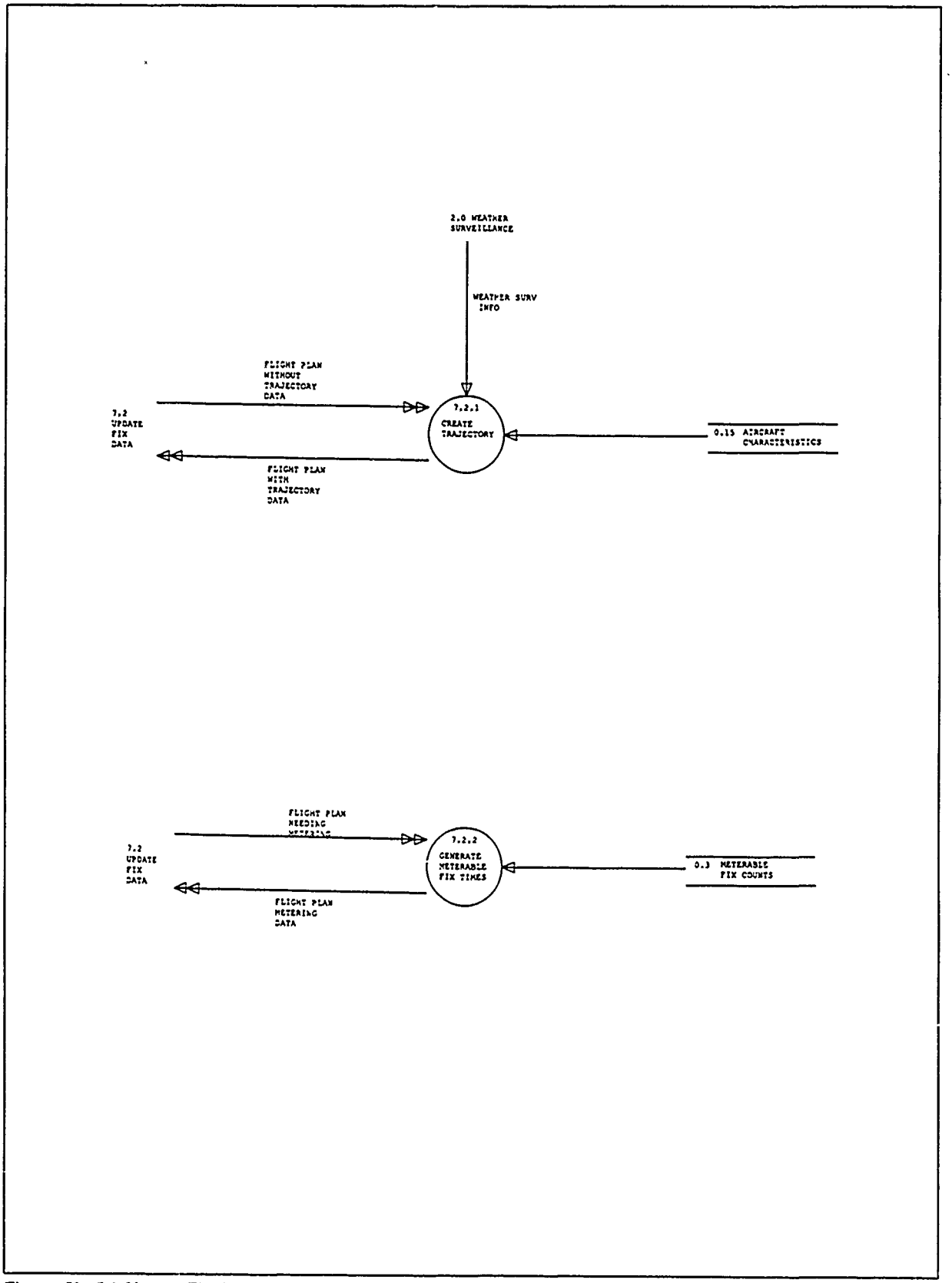


Figure 52. 7.2 Update Fix Data DFD. This figure is the data flow diagram for the IOM Object, 7.2 Update Fix Data

7.2.1 Create Trajectory

7.2.1 Description

Create Trajectory receives the flight plan from Update Fix Data. It creates the trajectory for the flight data and returns the flight plan to Update Fix Data.

7.2.1 Inputs

- FP_WITHOUT_TRAJECTORY_DATA - FP sent from UPDATE FIX DATA to CREATE TRAJECTORY for the purpose of filling in the trajectory data.
- WEATHER_SURV_INFO - Weather data sent from WEATHER SURVEILLANCE to CREATE TRAJECTORY. Used with Aircraft Characteristics and fixes to determine trajectory.

7.2.1 Outputs

- FP_WITH_TRAJECTORY_DATA - FP sent from CREATE TRAJECTORY to UPDATE FIX DATA after the trajectory data has been provided.

7.2.2 Generate Meterable Fix Times

7.2.2 Description

Generate Meterable Fix Times receives the flight plan with trajectory data. A list containing an estimated time of arrival for each meterable fix is created and returned to Update Fix Data.

7.2.2 Inputs

- FP_NEEDING_METERING - FP sent from UPDATE FIX DATA to GENERATE METERABLE TIMES for the purpose of calculating metering for its fixes.

7.2.2 Outputs

- FP_METERING_DATA - Metering data for the FP, sent from GENERATE METERABLE FIX TIMES to UPDATE FIX DATA so it can pass the data to the appropriate place.

7.3 Strip/Handoff Processing Discussion

When a request for a strip is received by Strip/Handoff Processing, Generate Strip is called to generate the strip data. When Strip/Handoff Processing receives notification that a handoff is required, Initiate Handoff-Out is called to generate the data to be sent to the controller or the down-route center for the handoff. When the controller When Strip/Handoff Processing is notified that the controller acknowledged the handoff, Handoff-Out Processing is called to update the appropriate databases. Figure 53 on page 161 presents the processing controlled by Strip/Handoff Processing.

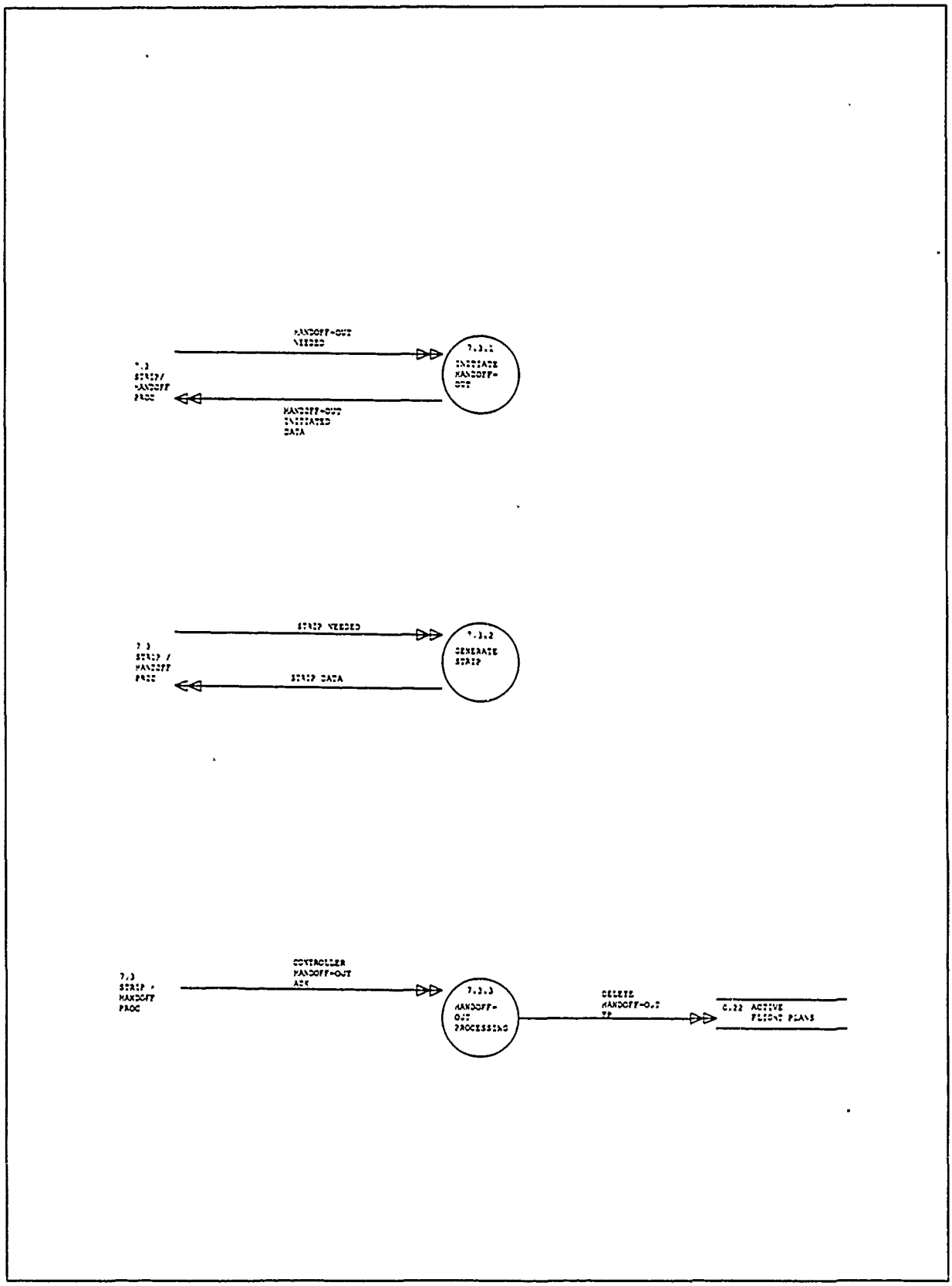


Figure 53. 7.3 Strip/Handoff Processing DFD. This figure is the DFD for the IOM Object, 7.3 Strip/Handoff Processing.

7.3.1 Initiate Handoff-Out Processing Discussion

7.3.1 Description

Initiate Handoff-Out Processing Receives a request to initiate a handoff from STRIP/HANDOFF Processing. Data for the controller is generated and sent to Strip/Handoff Processing to be sent to the appropriate controller. Generate Strip is called to generate the strip for the next controller.

7.3.1 Inputs

- HANDOFF-OUT_NEEDED -STRIP/HANDOFF PROC initiates INITIATE HANDOFF with this indication that a handoff-out is needed.

7.3.1 Outputs

- HANDOFF-OUT_INITIATED_DATA - Data from INITIATE HANDOFF-OUT to STRIP/HANDOFF PROC to be sent to the controller.

7.3.2 Generate Strip Discussion

7.3.2 Description

Generate Strip generates a strip for the flight plan. The strip is sent to Strip/Handoff Processing to be sent to the appropriate controller.

7.3.2 Inputs

- STRIP_NEEDED - Indication from STRIP/HANDOFF PROC to GENERATE STRIP that a strip is needed.

7.3.2 Outputs

- STRIP_DATA - Strip data sent from GENERATE STRIP to STRIP/HANDOFF PROC for distribution to the appropriate controller/area.

7.3.3 Handoff-Out Processing

7.3.3 Description

Handoff-Out Processing receives the flight plan for which a handoff was acknowledged from Strip/Handoff Processing. If the flight plan was handed-off to a down-route center, it is deleted from the Active Flight Plan Database.

7.3.3 Inputs

- CONTROLLER_HANDOFF-OUT_ACK - Acknowledgement sent from STRIP/HANDOFF PROC to HANDOFF-OUT PROC to indicate the controller acknowledged a handoff-out.

7.3.3 Outputs

- DELETE_HANDOFF-OUT_FP - Delete the FP that was handoff-out processed from the ACTIVE FP database for this area.

Section Supplement

This section provides summary reports on data employed and derived by the functional object 7.0 Flight Plan Operations Support.

Flight Plan Operation Support Information Flows

The following report identifies the inputs to and outputs from each of the functional objects in the Flight Plan Entry Support process.

GRAPH NAME: 7.0 INTERFACES GRAPH FILE: PERQ01.TPS

PROCESS: 7.0 LABEL: FLIGHT PLAN OPERATIONSSUPPORT

INPUT	OUTPUT
DF VALIDATED_FLIGHT_PLANS	
REC FLIGHT_PLAN	*,
E FLIGHT_PLAN_ID	*,
R AIRCRAFT_DATA	*,
R SPEED	*,
E DEPARTURE_LOCATION	*,
E ASSIGNED/REQUESTED_ALTITUDE	*,
R ROUTE_DATA	*,
E REMARKS	*,
DF CONTROLLER_ACK_HANDOFF-OUT	*,
REC CONTROLLER_ACK_HANDOFF_OUT	*,
E FLIGHT_PLAN_ID	*,
	DF FP_WITHOUT_ROUTE_DATA
*,	. REC FLIGHT_PLAN
*,	. . E FLIGHT_PLAN_ID
*,	. . R AIRCRAFT_DATA
*,	. . R SPEED
*,	. . E DEPARTURE_LOCATION
*,	. . E ASSIGNED/REQUESTED_ALTITUDE
*,	. . R ROUTE_DATA
*,	. . E REMARKS
	DF FP_WITH_TIME_UPDATES
	REC FLIGHT_PLAN
*,	. . E FLIGHT_PLAN_ID
*,	. . R AIRCRAFT_DATA
*,	. . R SPEED
*,	. . E DEPARTURE_LOCATION
*,	. . E ASSIGNED/REQUESTED_ALTITUDE
*,	. . R ROUTE_DATA
*,	. . E REMARKS
	DF STRIP_REQUIRED
*,	. ELE FLIGHT_PLAN_ID
	DF HANDOFF-OUT_INIT_REQUIRED
	REC HANDOFF-OUT_INIT_REQUIRED
*,	. . E FLIGHT_PLAN_ID
	E FLIGHT_LOCATION
*,	DF CONTROLLER_ACK_HANDOFF-OUT
*,	. REC CONTROLLER_ACK_HANDOFF_OUT
*,	. . E FLIGHT_PLAN_ID

*,, Means Updated Data

PROCESS: 7.1 LABEL: EXP4?0 ROUTE

INPUT OUTPUT

```
DF FP_WITHOUT_ROUTE_DATA                          |
    REC FLIGHT_PLAN . . . . . .*                  |
     E FLIGHT_PLAN_ID . . . . . .*                |
     R AIRCRAFT_DATA. . . . . .*                  |
     R SPEED. . . . . .*                          |
     E DEPARTURE_LOCATION . . . . . .*            |
     E ASSIGNED/REQUESTED_ALTITUDE. . . . . .*    |
     R ROUTE_DATA . . . . . .*                    |
     E REMARKS. . . . . .*                        |
                                                  |DF ROUTE_ERRORS              ROUTE ERRORS
                                                  |   SLE ROUTE_ERRORS
                                                  |DF FP_WITH_ROUTE_DATA
              *. . . . . | . .REC FLIGHT_PLAN
              *. . . . . | . . .E FLIGHT_PLAN_ID
              *. . . . . | . . .R AIRCRAFT_DATA
              *. . . . . | . . .R SPEED
              *. . . . . . . . .E DEPARTURE_LOCATION
              *. . . . . . . . .E ASSIGNED/REQUESTED_ALTITUDE
              *. . . . . | . . .R ROUTE_DATA
              *. . . . . | . . .E REMARKS
```

*... Means Updated Data

GRAPH NAME: 7.0 FLIGHT PLAN OPERATIONS GRAPH FILE: L3TU0N0.TRG

PROCESS: 7.2 LABEL: UPDATE FIX DATA

INPUT		OUTPUT
DF FP_WITH_ROUTE_DATA		
REC FLIGHT_PLAN	.....*	
E FLIGHT_PLAN_ID	.....*	
R AIRCRAFT_DATA	.....*	
R SPEED	.....*	
E DEPARTURE_LOCATION	.....*	
E ASSIGNED/REQUESTED_ALTITUDE	.....*	
R ROUTE_DATA	.....*	
E REMARKS	.....*	
DF FP_WITH_TIME_UPDATES		
REC FLIGHT_PLAN	.....*	
E FLIGHT_PLAN_ID	.....*	
R AIRCRAFT_DATA	.....*	
R SPEED	.....*	
E DEPARTURE_LOCATION	.....*	
E ASSIGNED/REQUESTED_ALTITUDE	.....*	
R ROUTE_DATA	.....*	
E REMARKS	.....*	
DF FP_WITH_TRAJECTORY_DATA		
REC FLIGHT_PLAN	.....*	
E FLIGHT_PLAN_ID	.....*	
R AIRCRAFT_DATA	.....*	
R SPEED	.....*	
E DEPARTURE_LOCATION	.....*	
E ASSIGNED/REQUESTED_ALTITUDE	.....*	
R ROUTE_DATA	.....*	
E REMARKS	.....*	
DF FP_METERING_DATA		
REC FLIGHT_PLAN_METERING_DATA		
E FIX		
E ESTIMATED_TIME_OF_ARRIVAL		
DF CONFLICT_SITUATIONS		
REC CONFLICT_SITUATIONS		
		DF CONFLICT_DATA
		REC CONFLICT_DATA
		DF FP_WITHOUT_TRAJECTORY
	*.....	...REC FLIGHT_PLAN
	*.....	...E FLIGHT_PLAN_ID
	*.....	...R AIRCRAFT_DATA
	*.....	...R SPEED
	*.....	...E DEPARTURE_LOCATION
	*.....	...E ASSIGNED/REQUESTED ALTITUDE
	*.....	...R ROUTE_DATA
	*.....	...E REMARKS
		DF FP_NEEDING_METERING
		REC FLIGHT_PLAN
	*.....	...E FLIGHT_PLAN_ID
	*.....	...R AIRCRAFT_DATA
	*.....	...R SPEED
	*.....	...E DEPARTURE_LOCATION
	*.....	...E ASSIGNED/REQUESTED_ALTITUDE

*... Means Updated Data

CONTINUED FROM PREVIOUS PAGE

PROCESS: 7.2 LABEL: UPDATE FIX DATA

INPUT	OUTPUT
*.	. . .R ROUTE_DATA
*.	. . .E REMARKS
	IDF FLIGHT_PLAN_CHANGES
	REC FLIGHT_PLAN
*.	. . .E FLIGHT_PLAN_ID
*.	. . .R AIRCRAFT_DATA
*.	. . .R SPEED
*.	. . .E DEPARTURE_LOCATION
*.	. . .E ASSIGNED.REQUESTED_ALTITUDE
*.	. . .R ROUTE_DATA
*.	. . .E REMARKS

*... Means Updated Data

PROCESS: 7.3 LABEL: STRIP / HANDOFF PROCESSING

INPUT	OUTPUT
IF STRIP_REQUIRED	
ELE FLIGHT_PLAN_ID.	. . . . . *
IF HANDOFF-OUT_INIT_REQUIRED	
REC HANDOFF-OUT_INIT_REQUIRED	
E FLIGHT_PLAN_ID	. . . . . *
E FLIGHT_LOCATION.	. . . . . *
IF CONTROLLER_ACK_HANDOFF-OUT	
REC CONTROLLER_ACK_HANDOFF_OUT	
E FLIGHT_PLAN_ID	. . . . . *
IF HANDOFF-OUT_INITIATED_DATA	
REC HANDOFF-OUT_INITIATED_DATA.	. . . . . *
E FLIGHT_PLAN_ID	. . . . . *
E FLIGHT_LOCATION.	. . . . . *
IF STRIP_DATA	
REC STRIP_DATA.	. . . . . *
	IOF FLIGHT_PLAN_STRIPS_HANDOFF-OUT
	REC FLIGHT_PLAN_STRIPS_HANDOFF-OUT
*.	. . .R STRIP_DATA
*.	. . .R HANDOFF-OUT_INITIATED_DATA
	IOF HANDOFF-OUT_NEEDED
	REC HANDOFF-OUT_NEEDED
*.	. . .E FLIGHT_PLAN_ID
*.	. . .E FLIGHT_LOCATION
	IOF STRIP_NEEDED
*.	. .ELE FLIGHT_PLAN_ID
	IOF CONTROLLER_HANDOFF-OUT_ACK
	ELE FLIGHT_PLAN_ID

*... Means Updated Data

GRAPH NAME: 7.2 UPDATE FIX DATA GRAPH FILE: L3TEEDO.TRG

PROCESS: 7.2.1 LABEL: CREATE TRAJECTORY

INPUT	OUTPUT
DF FP_WITHOUT_TRAJECTORY	
REC FLIGHT_PLAN	.*
E FLIGHT_PLAN_ID	.*
R AIRCRAFT_DATA	.*
R SPEED	.*
E DEPARTURE_LOCATION	.*
E ASSIGNED/REQUESTED_ALTITUDE	.*
R ROUTE_DATA	.*
E REMARKS	.*
DF WEATHER_SURV_INFO	
	DF FP_WITH_TRAJECTORY_DATA
*.	. .REC FLIGHT_PLAN
*.	. . .E FLIGHT_PLAN_ID
*.	. . .R AIRCRAFT_DATA
*.	. . .R SPEED
*.	. . .E DEPARTURE_LOCATION
*.	. . .E ASSIGNED/REQUESTED_ALTITUDE
*.	. . .R ROUTE_DATA
*.	. . .E REMARKS

*... Means Updated Data

PROCESS: 7.2.2 LABEL: GENERATE METERABLE FIX TIMES

INPUT	OUTPUT
DF FP_NEEDING_METERING	
REC FLIGHT_PLAN	
E FLIGHT_PLAN_ID	
R AIRCRAFT_DATA	
R SPEED	
E DEPARTURE_LOCATION	
E ASSIGNED/REQUESTED_ALTITUDE	
R ROUTE_DATA	
E REMARKS	
	DF FP_METERING_DATA
	REC FLIGHT_PLAN_METERING_DATA
	E FIX
	E ESTIMATED_TIME_OF_ARRIVAL

*... Means Updated Data

GRAPH NAME: 7.3 STRIP/HANDOFF PROC GRAPH FILE: KBTYSTJ.TRG

PROCESS: 7.3.1 LABEL: INITIATE HANDOFF- OUT

INPUT	OUTPUT
DF HANDOFF-OUT_NEEDED	
REC HANDOFF-OUT_NEEDED	
E FLIGHT_PLAN_ID	.*
E FLIGHT_LOCATION	.*
	DF HANDOFF-OUT_INITIATED_DATA
	REC HANDOFF-OUT_INITIATED_DATA
*	.E FLIGHT_PLAN_ID
*	.E FLIGHT_LOCATION

*... Means Updated Data

PH NAME: 7.3 STRIP/HANDOFF PROC GRAPH FILE: KBTYCTJ.TRG

ROCESS: 7.3.2 LABEL: GENERATE STRIP

INPUT	OUTPUT
DF STRIP_NEEDED	
ELE FLIGHT_PLAN_ID	
	DF STRIP_DATA
	REC STRIP_DATA

*... Means Updated Data

PP NAME: 7.3 STRIP/HANDOFF PROC GRAPH FILE: KBTYCTJ.TRG

PROCESS: 7.3.3 LABEL: HANDOFF- OUT PROCESSING

INPUT	OUTPUT
DF CONTROLLER_HANDOFF-OUT_ACK	
ELE FLIGHT_PLAN_ID.	. . . . . *
	DF DELETE_HANDOFF-OUT_FP
*	. .ELE FLIGHT_PLAN_ID

*... Means Updated Data

Since Flight Plan Operation Support is closely tied Flight Plan Entry Support, refer to the Information Flows described in the Section Supplement for Flight Plan Entry Support.

8.0 Area Control

This section is not formally documented. This entry was included, for coverage completeness, from available materials.

Introduction

The AREA CONTROL encapsulates the functions of the Enroute and Approach Control Facilities. It provides Area Flow Control, which interfaces with the National Flow Controller, for the effective and safe utilization of airspace and managing airspace congestion.

The AREA CONTROL object will be introduced by four graphics, namely:

- The Area Control View From
- The Area Control Interfaces
- The Area Control Functional Object Tree
- Area Control.

8.0 Area Control "View From"

The DoD AAS Area Control view from 8.0 AREA CONTROL is illustrated by Figure 54 on page 166. The "view from" presents all of the major functional objects of the DoD AAS Area Control and their relationship to AREA CONTROL by the messages that are passed to and from it.

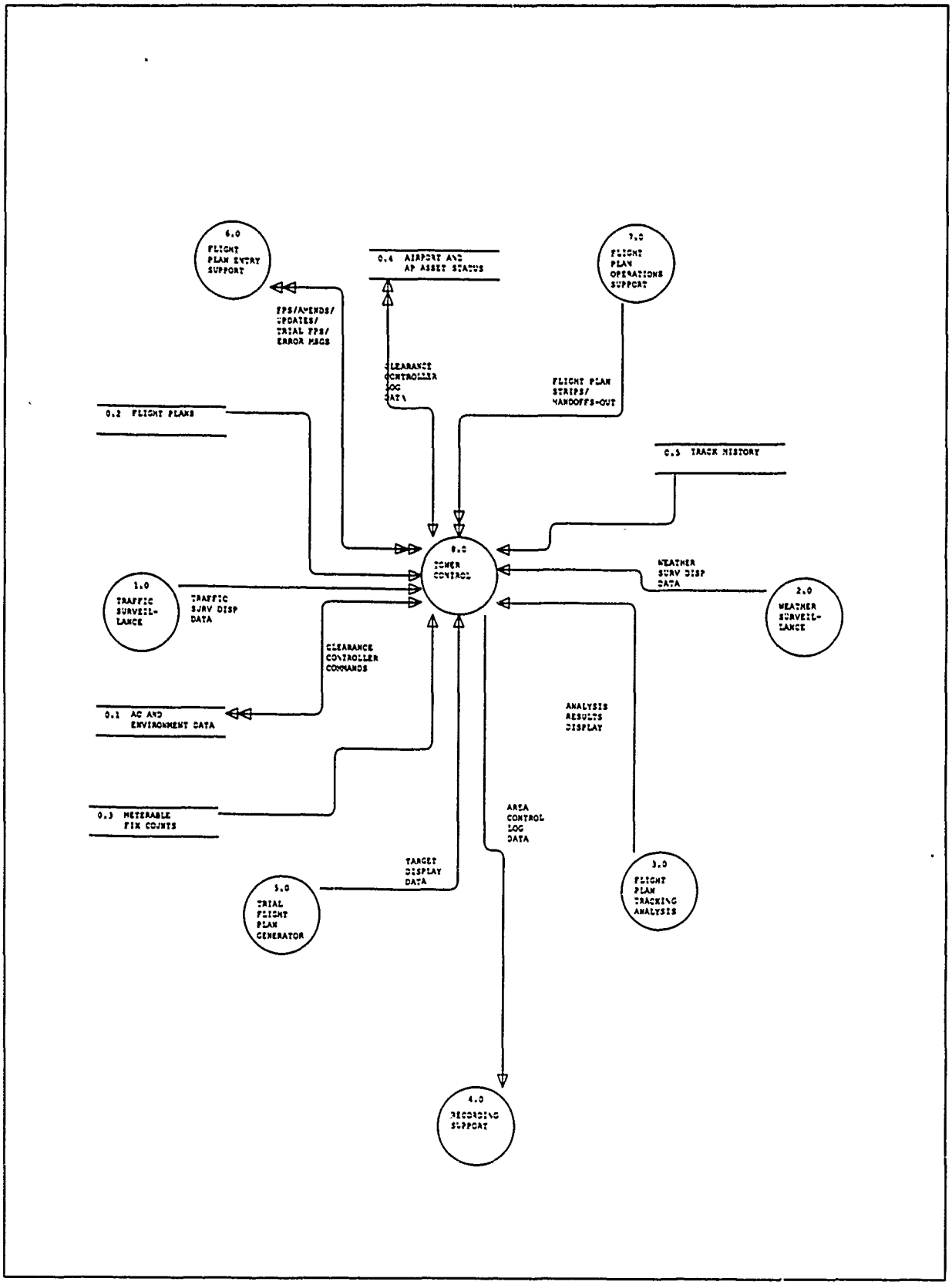


Figure 54. DoD AAS Area Control View from Area Control. This figure illustrates the view of DoD AAS Area Control with respect to AREA CONTROL. This diagram also presents all of the major functional objects of the DoD AAS Area Control IOM and the message "pipes" that connect them to AREA CONTROL.

8.0 Area Control Interfaces

The interfaces to AREA CONTROL are illustrated on Figure 55 on page 168.

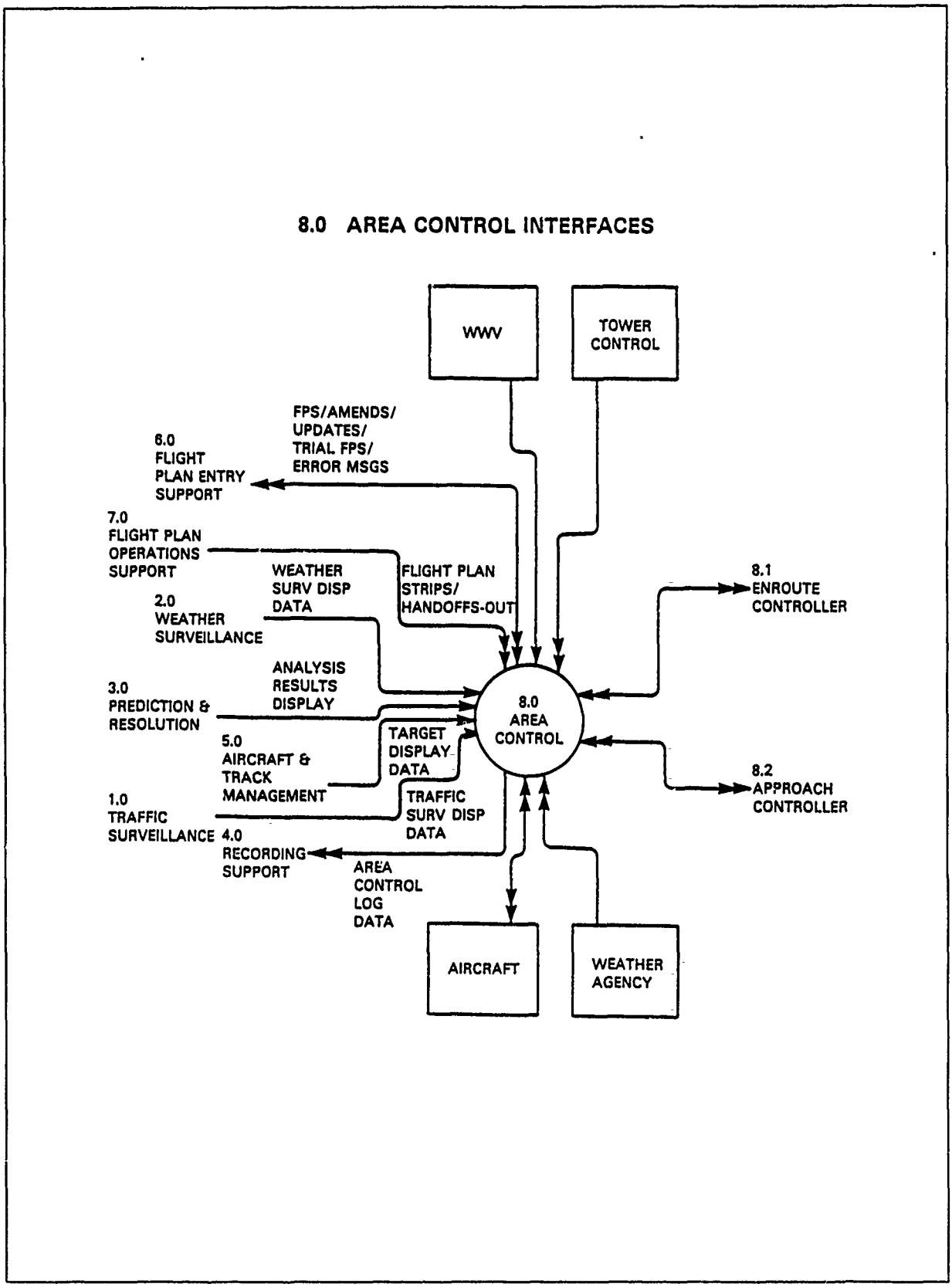


Figure 55. Interfaces for 8.0 AREA CONTROL. This figure illustrates the interfaces of the the 8.0 Area Control functional object. This diagram shows the major inputs from other DoD AAS Area Control functional objects and external interfaces.

8.0 Area Control Inputs

Not available.

8.0 Area Control Outputs

Not available.

1.0 Area Control Functional Object Tree

The functional object tree for 1.0 AREA CONTROL presents the object hierarchy of AREA CONTROL, as illustrated in Figure 56 on page 170 The functional object tree presents all of the graphics used to describe AREA CONTROL, as well as the message communication paths that show communication between peer objects, parent objects to child objects, and child to parent objects.

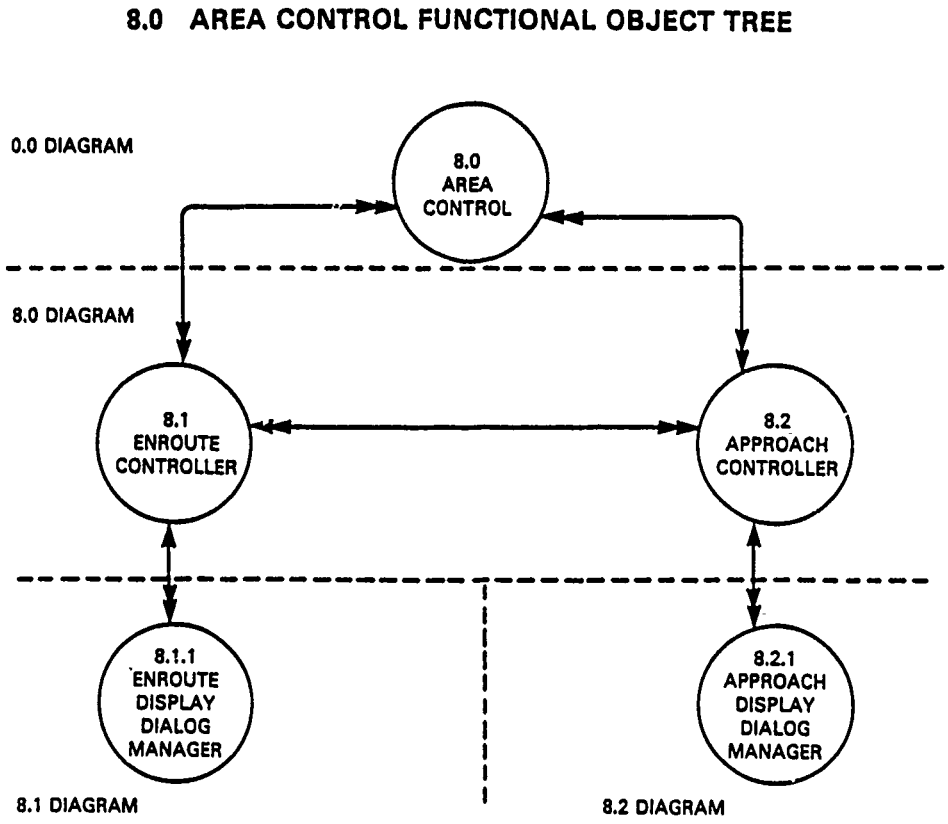


Figure 56. Functional Object Tree for 1.0 Area Control. This figure illustrates the functional object tree for the AREA CONTROL functional object. This tree shows the hierarchic relationship between the subordinate functional objects and shows message passing between peer objects, parent objects and child objects on different levels; It also identifies the communication paths between the decomposition levels.

Area Control Discussion

The figure illustrating Area Control is presented in Figure 57 on page 172 This figure illustrates the information flow from other system objects and the information flow between the Enroute Controller and the Approach Controller objects.

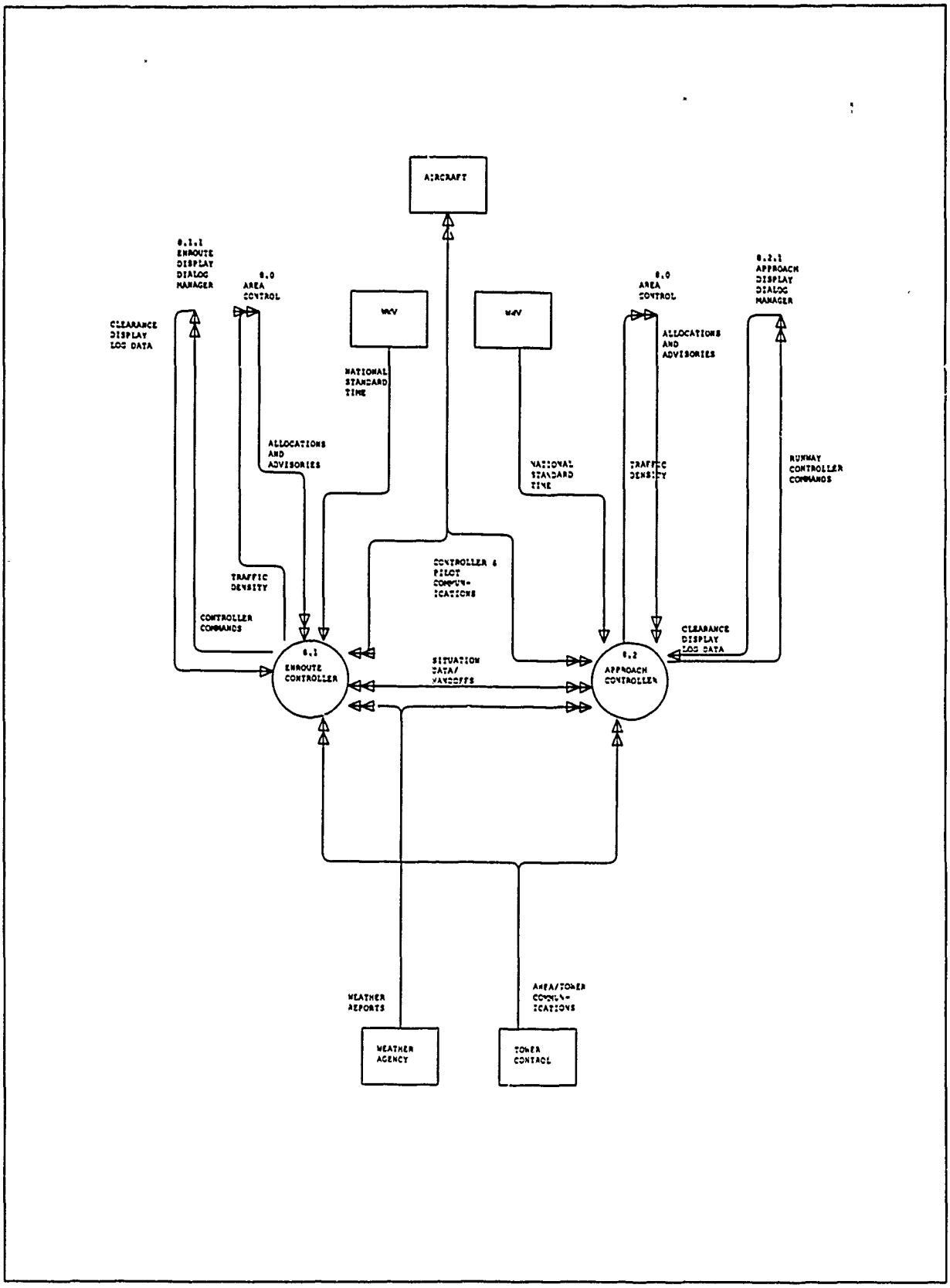


Figure 57. 8.0 Area Control. This figure illustrates the first level of decomposition of AREA CONTROL functional object, and illustrates the information flow between Enroute Controller and Approach Controller objects.

8.1 Enroute Controller

The human component of the Enroute controller is described below.

- Generally has a very large airspace to monitor and control;
- Uses information from the integrated information view and external sources to guide and control aircraft in a safe fashion;
- Updates system time according to WWV;
- Monitors weather reports from pilots and national weather agencies in order to enter the information in to the computer system;
- Answers many different kinds of pilot questions;
- Receives traffic advisories from Area Control;
- Controls the way in which data is presented on the computer screen;
- Receives/performs handoffs from/to other Enroute controllers as well as Approach Controllers.

8.2 Approach Controller

The human component of the Approach Controller is described below.

- Airspace is limited to a short range around the airport;
- Does much the same thing as the Enroute Controller;
- Receives/performs handoffs from/to Enroute controllers and Tower controllers.

8.1 Enroute Controller Discussion

The figure illustrating the decomposition of the Enroute Controller is illustrated in Figure 58 on page 175.

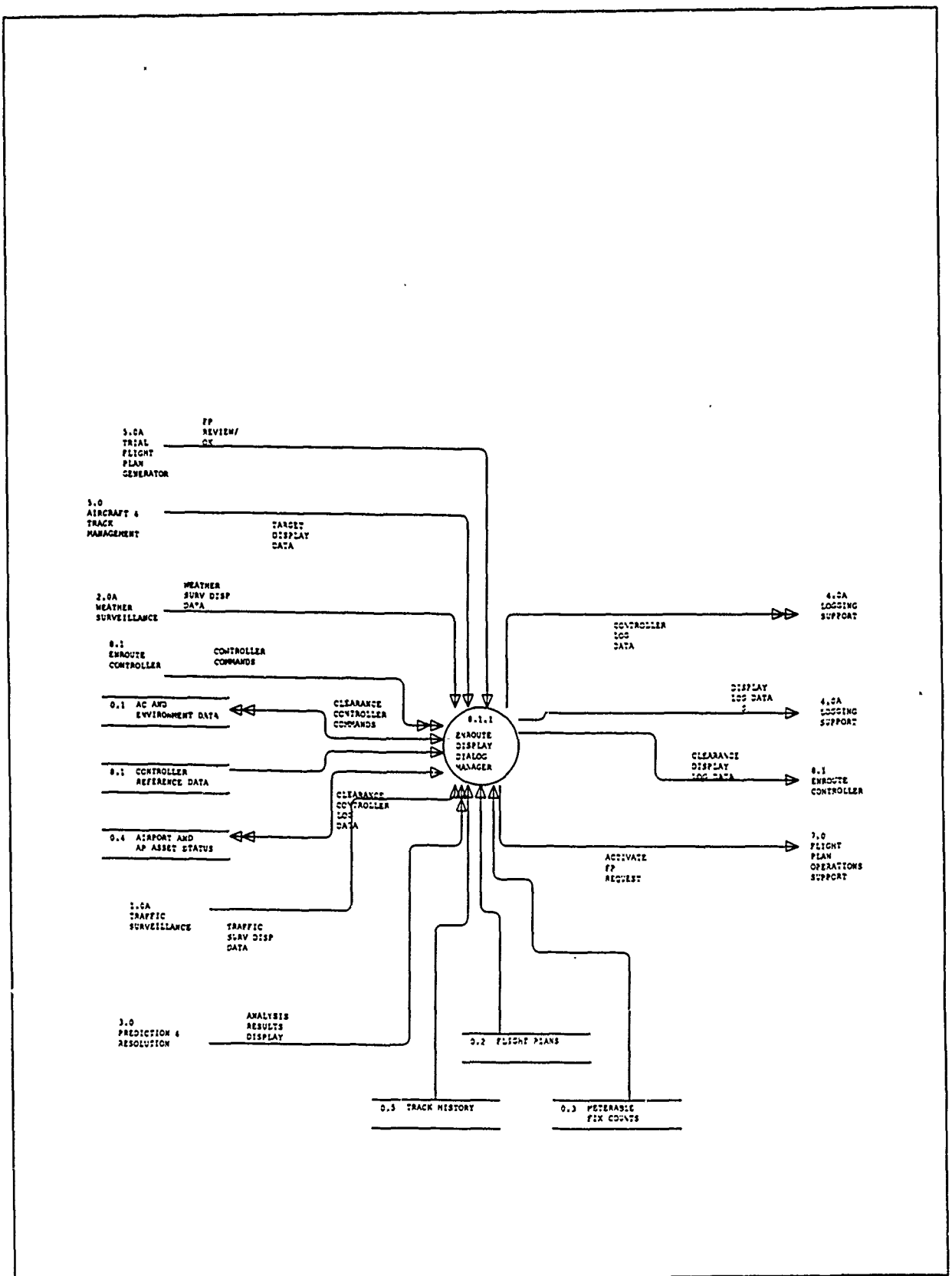


Figure 58. 8.1 Enroute Controller. This figure illustrates the first level of decomposition of Enroute Controller functional object, showing the Enroute Display Dialog Manager object.

8.1.1 Enroute Display Dialog Manager

- Receives information from all of the other objects and some outside sources, formats it to the controllers liking, and displays it on the screen;
- Accepts controller commands and requests for information. These commands are then passed on to the appropriate functions;
- Logs screen images for future playback;
- Logs all controller requests and commands;
- Performs pointout functions.

8.2 Approach Controller Discussion

The figure illustrating the decomposition of the Approach Controller is illustrated in Figure 59 on page 178.

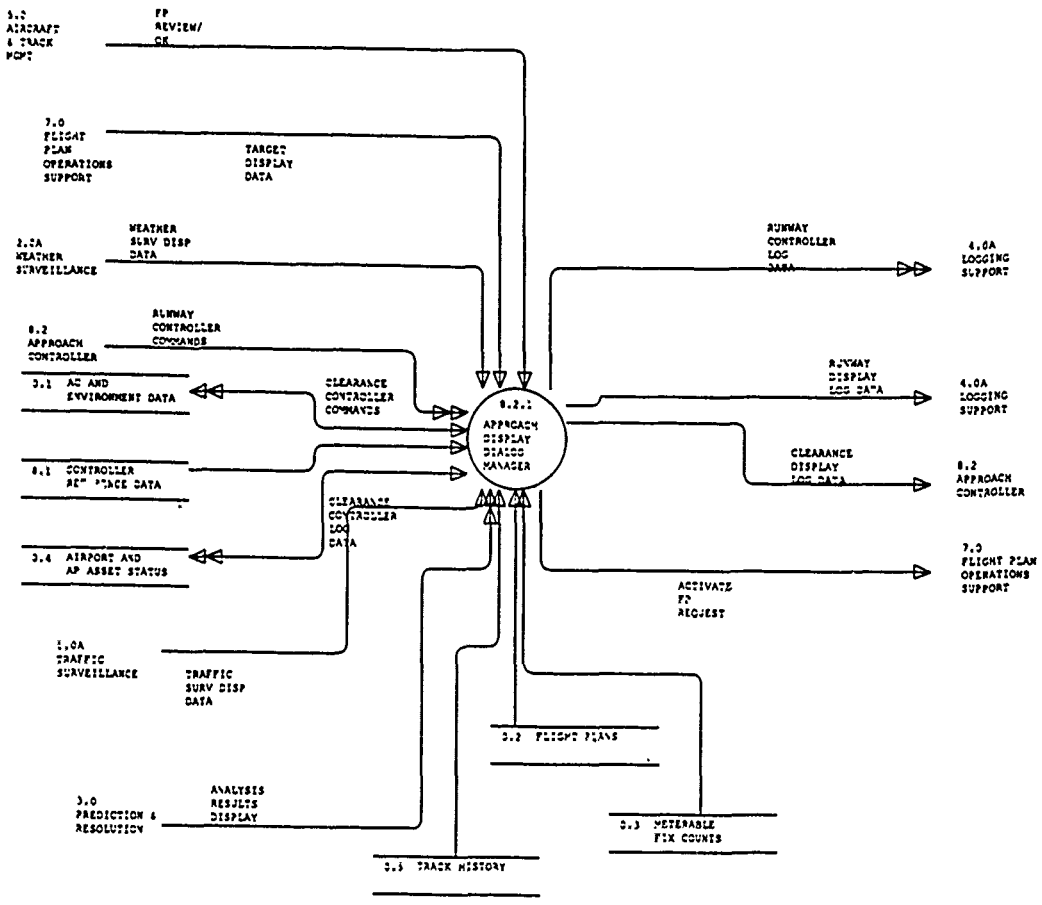


Figure 59. 8.2 Approach Controller. This figure illustrates the first level of decomposition of Approach Controller functional object, showing the Approach Display Dialog Manager object.

8.2.1 Approach Display Dialog Manager

- Receives information from all of the other objects and some outside sources, formats it to the controllers liking, and displays it on the screen;
- Accepts controller commands and requests for information. These commands are then passed on to the appropriate functions;
- Logs screen images for future playback;
- Logs all controller requests and commands;
- Performs Pointout functions.

8.0 Tower Control Discussion

8.1 Ground Controller

- Responsible for all the safe movement of all ground.
- Controls aircraft while traveling from gate to runway. traffic.
- Issues handoff to Tower Controller.

8.2 Tower Controller

- Responsible for the safe takeoff and landing of all aircraft.

8.3 Clearance Controller

- Obtains all necessary clearances for an aircraft to takeoff.
- Issues handoff to Ground Control.

Section Supplement

This section provides summary reports on data employed and derived by the functional object 8.0 Area Control.

"All Data Flows" Report

The following report, generated from the Excelerator database, identifies all data flows for the Area Control object.

Name	Alternate Name	Short Descrip.	Last Modify Date
SCF18	AC AND ENVIRONMENT DATA	Record containing much of the data stored in AAS.	891216
SCF19	AIRPORT AND AP ASSET STATUS	Contains most of the information that defines an airport and the equipment it has.	891216
SCF15	APPROACH CONTROLLER COMMANDS	Commands and requests from the approach controller to the operational air traffic control system.	891216
SCF16	APPROACH CONTROLLER LOG DATA	Commands and requests made by the approach controller which are to be logged.	891216
SCF17	APPROACH DISPLAY LOG DATA	Contains information necessary to recreate the image a given controller sees at a given time.	891216
SCF14	AREA CONTROL LOG DATA	Data that needs to be logged as a result of controller actions or images displayed to controller.	891216
SCF08	AREA TOWER COMMUNICATIONS	Communications that must go from the area controllers to the tower controllers (include handoffs, requests, etc.)	891216
SCF07	CONTROLLER PILOT COMMUNICATIONS	Communication from a controller to a pilot and from a pilot back to a controller.	891216
SCF10	ENROUTE CONTROLLER COMMANDS	Commands and requests from the enroute controller to the operational air traffic control system.	891216
SCF00	ENROUTE CONTROLLER LOG DATA	Consists of all keystrokes the controller makes. This includes queries, commands and view preferences.	891216
SCF11	ENROUTE DISPLAY LOG DATA	Data necessary to recreate the screen images of a given controller at a given time.	891216
SCF20	INTEGRATED INFORMATION VIEW	The screen image containing situation information and other controller requested information.	891216
SCF06	NATIONAL STANDARD TIME	The national standard time used to synchronize all air traffic control facilities.	891216
SCF02	SITUATION DATA AND HANDOFFS	Information that needs to be passed between approach controllers and enroute controllers.	891216
SCF04	TRAFFIC DENSITY	A report from the enroute controller containing information about the amount of traffic in a given area.	891216
SCF01	VIEW PREFERENCES	Commands from the controller, telling PRESENTATION SERVICES the manner in which to format the display (e.g. colors).	891211
SCF05	WEATHER REPORTS	Weather reports from national weather sources such as ACCU weather.	891216

"All Records and their Elements" Report

The following report, generated from the Excelerator database, identifies all the records and their elements for the Area Control object.

Name	=(ELE/REC Name	)+ Definition
AC AND ENVIRONMENT DATA	=(AIRSPACE BOUNDARIES	
	+ GROUND OBSTACLES	
	+ GEOGRAPHIC DATA	
	+ RULES AND REGULATIONS	
	+ AIRCRAFT CHARACTERISTICS	
	+ ESTABLISHED ROUTES	
	+ NAVAGATION AID FIXES)	
AIRCRAFT CHARACTERISTICS	=(AC TYPE	Contains information about specific kinds of A/C
	+ MAX VELOCITY	
	+ MIN VELOCITY	
	+ MAX ALTITUDE	
	+ AC WEIGHT)	
AIRSPACE BOUNDARIES	=(AIRSPACE ID	Describes a given area on the airspace being controlled.
	+ COORDINATE LIST)	
AIRWAY FIXES	+(FIX MAP DATA	Fix specification information
	+ AIRWAY DIRECTION FIX IND	
	+ FIX JUNCTIONING DATA	
	+ FIX COORDINATION DATA	
	+ FIX SEGMENT DATA	
	+ FIX NAME)	
AIRWAY ROUTE DATA	=(AIRWAY IDENTIFIER	Airway route data identifying all info about routes.
	+ AIRWAY FIXES)	
ALLOCATIONS AND ADVISORIES		Suggested amount of traffic through certain areas.
AREA TOWER COMMUNICATIONS		Communications between the area and tower controllers.
CONTROLLER PILOT COMMUNICATIONS		Communications between the pilot and controller
COORDINATE LIST	=(X COORDINATE	Seq. of points in system coordinates defining airspace
	+ Y COORDINATE	
	+ Z COORDINATE)	
ESTABLISHED ROUTES	=(PREF ROUTES	Classifications of airway routes
	+ STERED ROUTES)	
FIX COORDINATION DATA	=(FIX COORDINATION TYPE	Dest. for coordination FDEs generated when primary gener.
	+ FIX COORDINATION DIRECTION	
	+ FIX COORDINATION ALTITUDES	
	+ FIX COORDINATION CENTERS	
	+ FIX COORDINATION AREAS)	
FIX DATA	=(FIX NAME	Information needed to locate a fix.
	+ FIX LOCATION DATA)	
FIX JUNCTIONING DATA	=(FIX JUNCTIONING TYPE	Identifies all routes that intersect at specific fix
	+ FIX JUNCTIONING NAME)	

Name	=(ELE/REC Name)+	Definition
FIX LOCATION DATA	=(AIRPORT INDICATOR	Location record for fixes
	+ FIX LATITUDE	
	+ FIX LONGITUDE	
	+ FIX MAGNETIC DECLINATION	
	+ FIX WIND STATION	
	+ BOUNDARY CROSSING FIX IND	
	+ FIX MAP DATA)	
FIX MAP DATA	=(FIX MAP CLASS TYPE	Information about the map line begun or ended at fix
	+ FIX MAP DASH VALUE	
	+ FIX MAP START NUMBERS	
	+ FIX MAP STOP NUMBERS)	
GEOGRAPHIC DATA		
GROUND OBSTACLES	=(GROUND OBSTACLE NAME	List of Ground obstacles needing to be avoided by AC.
	+ GROUND OBSTACLE ID	
	+ COORDINATE LIST)	
NAVAGATION AID FIXES	=(AIRWAY FIXES)	Fixes used to aid in navigation
RULES AND REGULATIONS	=(RULE IDENTIFICATION	Defines the rules and regulations required by facilities.
	+ RULE DESCRIPTION)	
SEPERATION CRITERIA	=(AIRCRAFT PAIR TYPE	Criteria used by conflict probe to ascertain min sep.
	+ PREFERRED HORIZ SEPERATION	
	+ PREFERRED VERT SEPERATION	
	+ SECONDARY HORIZ SEPERATION	
	+ SECONDARY VERT SEPERATION)	
SID DATA	=(SID IDENTIFIER	Standard Instrument Departure data record
	+ ROUTE NAME & AIRCRAFT CLASS	
	+ SID ELIGIBLE ALTITUDES	
	+ SID ROUTE FIXES	
	+ SID STAR ACTIVE INACTIVE ID)	
SID ROUTE FIXES	=(DEPARTURE AIRPORT IND	List of fixes along the route
	+ AUTOMATIC TRACK INIT IND	
	+ AUTO HANDOFF POINT ALT	
	+ TRANSITION FIX IND	
	+ FIX COORDINATION DATA	
	+ FIX MAP DATA	
	+ FIX NAME	
	+ AUTO INTERIM ALTITUDE DATA)	
STEREO ROUTE DATA	=(STEREO TAG NAME	Stereo route information tag.
	+ STEREO AIRCRAFT DATA	
	+ STEREO SPEED	
	+ FIX COORDINATION DATA	
	+ STEREO ALTITUDE	
	+ STEREO REMARKS)	

Name	=(ELE/REC Name	)+	Definition
AC AND ENVIRONMENT DATA	=(AIRSPACE BOUNDARIES		
	+ GROUND OBSTACLES		
	+ GEOGRAPHIC DATA		
	+ RULES AND REGULATIONS		
	+ AIRCRAFT CHARACTERISTICS		
	+ ESTABLISHED ROUTES		
	+ NAVAGATION AID FIXES	)	
AIRCRAFT CHARACTERISTICS	=(AC TYPE		Contains information about specific kinds of A/C
	+ MAX VELOCITY		
	+ MIN VELOCITY		
	+ MAX ALTITUDE		
	+ AC WEIGHT	)	
AIRSPACE BOUNDARIES	=(AIRSPACE ID		Describes a given area on the airspace being controlled.
	+ COORDINATE LIST	)	
AIRWAY FIXES	+(FIX MAP DATA		Fix specification information
	+ AIRWAY DIRECTION FIX IND		
	+ FIX JUNCTIONING DATA		
	+ FIX COORDINATION DATA		
	+ FIX SEGMENT DATA		
	+ FIX NAME	)	
AIRWAY ROUTE DATA	=(AIRWAY IDENTIFIER		Airway route data identifying all info about routes.
	+ AIRWAY FIXES	)	
ALLOCATIONS AND ADVISORIES			Suggested amount of traffic through certain areas.
AREA TOWER COMMUNICATIONS			Communications between the area and tower controllers.
CONTROLLER PILOT COMMUNICATIONS			Communications between the pilot and controller
COORDINATE LIST	=(X COORDINATE		Seq. of points in system coordinates defining airspace
	+ Y COORDINATE		
	+ Z COORDINATE	)	
ESTABLISHED ROUTES	=(PREF ROUTES		Classifications of airway routes
	+ STERED ROUTES		
FIX COORDINATION DATA	=(FIX COORDINATION TYPE		Dest. for coordination FDEs generated when primary gener.
	+ FIX COORDINATION DIRECTION		
	+ FIX COORDINATION ALTITUDES		
	+ FIX COORDINATION CENTERS		
	+ FIX COORDINATION AREAS	)	
FIX DATA	=(FIX NAME		Information needed to locate a fix.
	+ FIX LOCATION DATA	)	
FIX JUNCTIONING DATA	=(FIX JUNCTIONING TYPE		Identifies all routes that intersect at specific fix
	+ FIX JUNCTIONING NAME	)	

Name	=(ELE/REC Name	)+	Definition
FIX LOCATION DATA	=(AIRPORT INDICATOR		Location record for fixes
	+ FIX LATITUDE		
	+ FIX LONGITUDE		
	+ FIX MAGNETIC DECLINATION		
	+ FIX WIND STATION		
	+ BOUNDARY CROSSING FIX IND		
	+ FIX MAP DATA	)	
FIX MAP DATA	=(FIX MAP CLASS TYPE		Information about the map line begun or ended at fix
	+ FIX MAP DASH VALUE		
	+ FIX MAP START NUMBERS		
	+ FIX MAP STOP NUMBERS	)	
GEOGRAPHIC DATA			
GROUND OBSTACLES	=(GROUND OBSTACLE NAME		List of Ground obstacles needing to be avoided by AC.
	+ GROUND OBSTACLE ID		
	+ COORDINATE LIST	)	
NAVAGATION AID FIXES	=(AIRWAY FIXES	)	Fixes used to aid in navigation
RULES AND REGULATIONS	=(RULE IDENTIFICATION		Defines the rules and regulations required by facilities.
	+ RULE DESCRIPTION	)	
SEPERATION CRITERIA	=(AIRCRAFT PAIR TYPE		Criteria used by conflict probe to ascertain min sep.
	+ PREFERRED HORIZ SEPERATION		
	+ PREFERRED VERT SEPERATION		
	+ SECONDARY HORIZ SEPERATION		
	+ SECONDARY VERT SEPERATION	)	
SID DATA	=(SID IDENTIFIER		Standard Instrument Departure data record
	+ ROUTE NAME & AIRCRAFT CLASS		
	+ SID ELIGIBLE ALTITUDES		
	+ SID ROUTE FIXES		
	+ SID STAR ACTIVE INACTIVE ID	)	
SID ROUTE FIXES	=(DEPARTURE AIRPORT IND		List of fixes along the route
	+ AUTOMATIC TRACK INIT IND		
	+ AUTO HANDOFF POINT ALT		
	+ TRANSITION FIX IND		
	+ FIX COORDINATION DATA		
	+ FIX MAP DATA		
	+ FIX NAME		
	+ AUTO INTERIM ALTITUDE DATA	)	
STEREO ROUTE DATA	=(STEREO TAG NAME		Stereo route information tag.
	+ STEREO AIRCRAFT DATA		
	+ STEREO SPEED		
	+ FIX COORDINATION DATA		
	+ STEREO ALTITUDE		
	+ STEREO REMARKS	)	

"All Data Stores" Report

The 8.0 Area Control object employs/updates the following globally defined data stores, defined in Appendix A of this document:

- AIRCRAFT_AND_ENVIRONMENT_DATA (employs/updates)
- METERABLE_FIX_COUNTS (employs)
- TRACK_HISTORY (employs)
- AIRPORT_AND_AP_ASSET_STATUS (employs/updates)
- FLIGHT_PLANS (employs).

4.0 Recording Support

This section is not formally documented. This entry was included for coverage completeness, from available materials.

Introduction

The 4.0 Recording Support object is responsible for managing and recording required log data.

The RECORDING SUPPORT object will be introduced by four graphics, namely:

- The Recording Support View From
- The Recording Support Interfaces
- The Recording Support Functional Object Tree
- Recording Support.

1.0 Recording Support "View From"

The DoD AAS Area Control view from 4.0 RECORDING SUPPORT is illustrated by Figure 60 on page 185. The "view from" presents all of the major functional objects of the DoD AAS Area Control and their relationship to RECORDING SUPPORT by the messages that are passed to and from it.

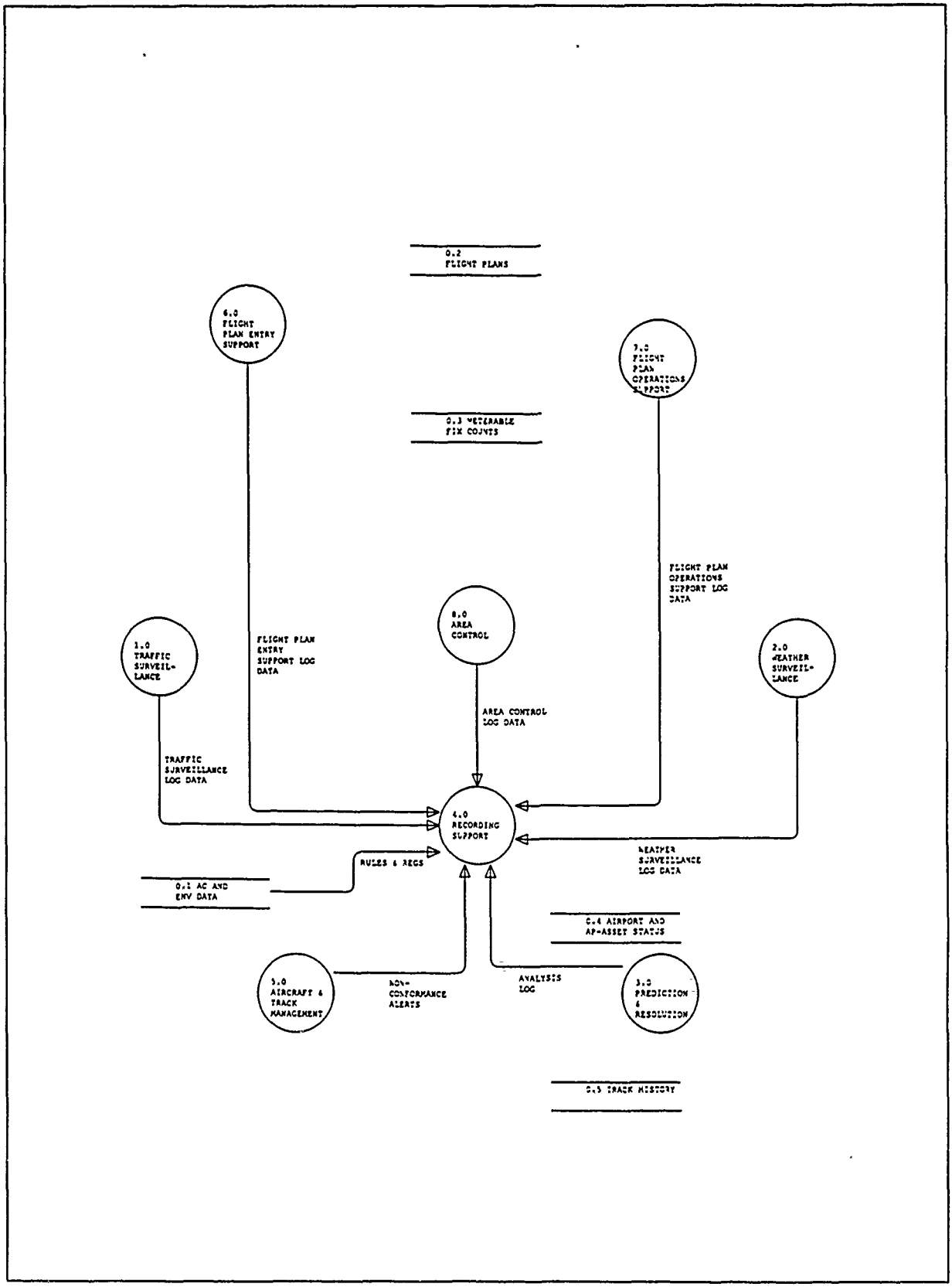


Figure 60. DoD AAS Area Control View from Recording Support. This figure illustrates the view of DoD AAS Area Control with respect to RECORDING SUPPORT. This diagram also presents all of the major functional objects of the DoD AAS Area Control IOM and the message "pipes" that connect them to RECORDING SUPPORT.

4.0 Recording Support Interfaces

The interfaces to RECORDING SUPPORT are illustrated on Figure 61 on page 187.

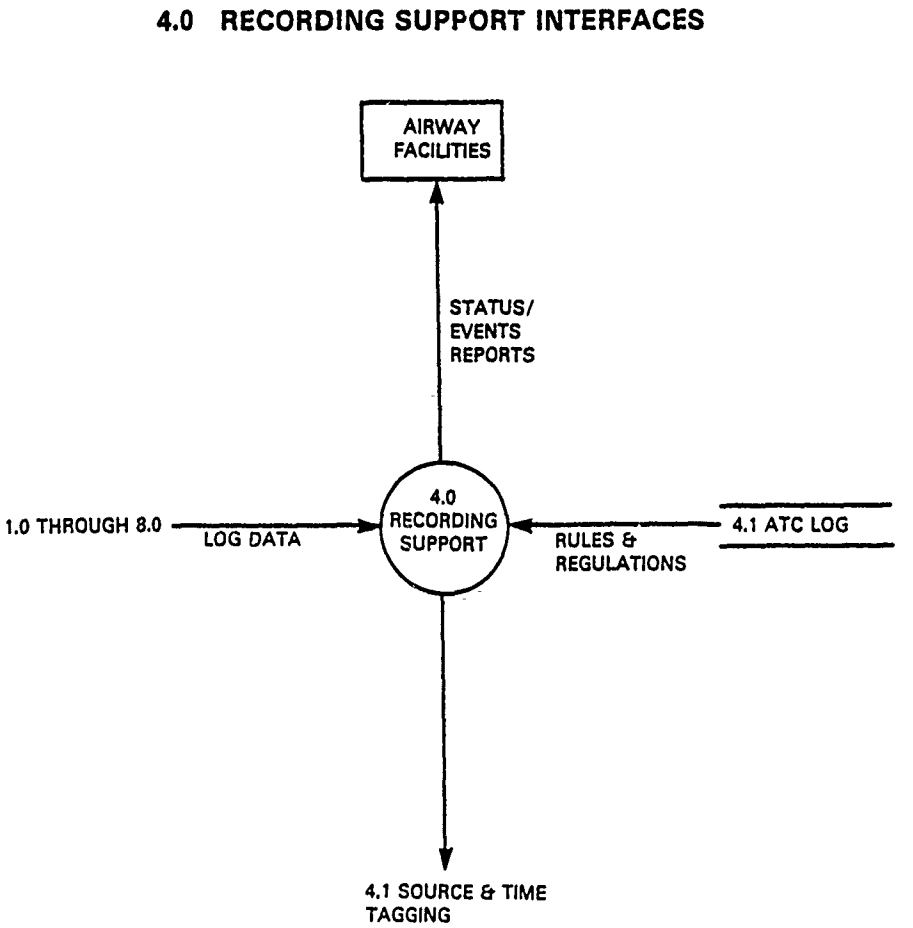


Figure 61. Interfaces for 4.0 RECORDING SUPPORT. This figure illustrates the interfaces of the the 4.0 Recording Support functional object. This diagram shows the major inputs from other DoD AAS Area Control functional objects and external interfaces.

4.0 Recording Support Inputs

Not available.

4.0 Recording Support Outputs

Not available.

1.0 Recording Support Functional Object Tree

The functional object tree for 1.0 RECORDING SUPPORT presents the object hierarchy of RECORDING SUPPORT, as illustrated in Figure 62 on page 189 The functional object tree presents all of the graphics used to describe RECORDING SUPPORT, as well as the message communication paths that show communication between peer objects, parent objects to child objects, and child to parent objects.

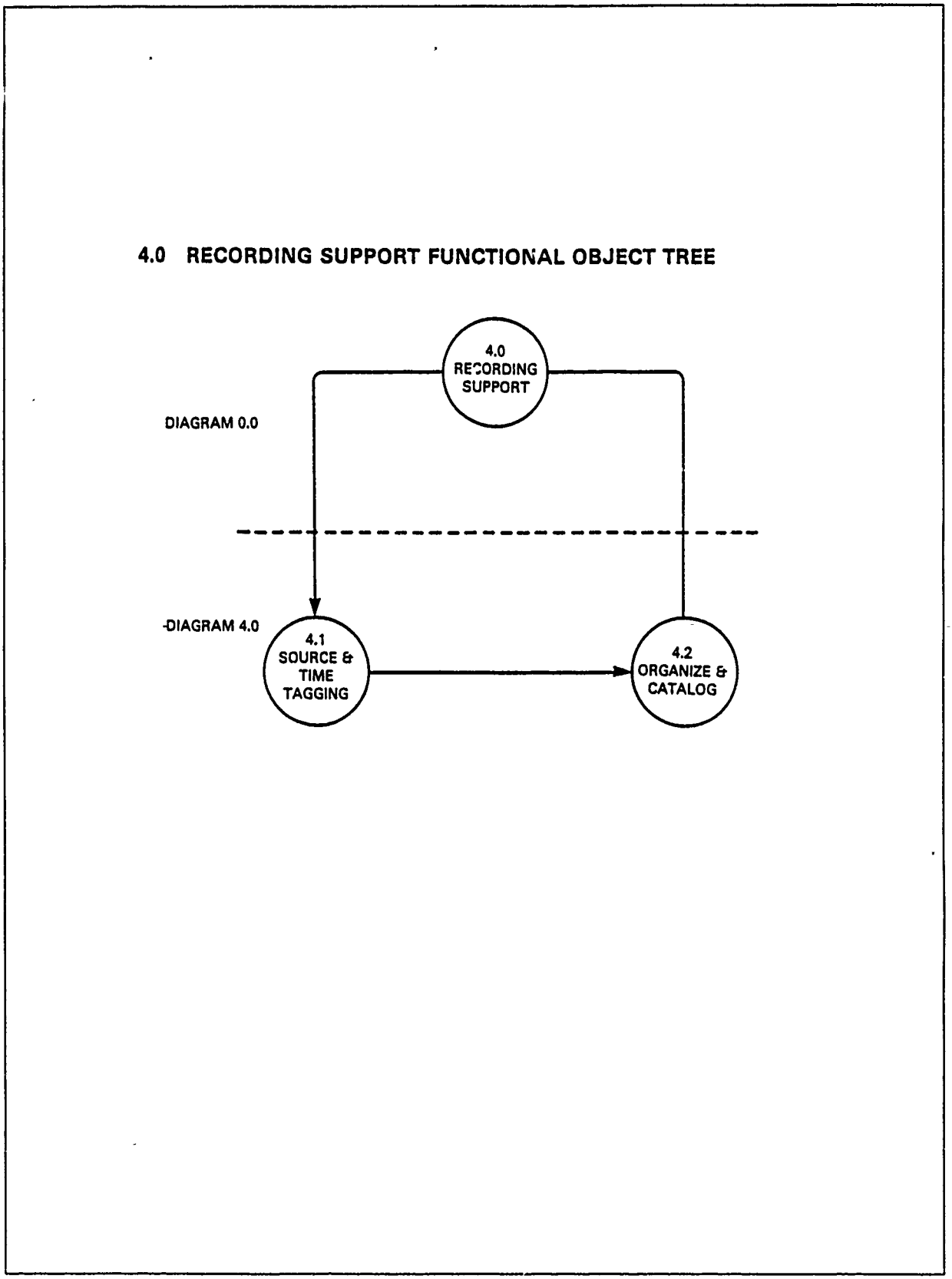


Figure 62. Functional Object Tree for 1.0 Recording Support. This figure illustrates the functional object tree for the RECORDING SUPPORT functional object. This tree shows the hierarchic relationship between the subordinate functional objects and shows message passing between peer objects, parent objects and child objects on different levels; It also identifies the communication paths between the decomposition levels.

Recording Support Discussion

Recording support is the process required for the logging of system data, which includes:

- ATC Traffic Counts - number of IFR aircraft, controller VFR aircraft; count of adapted routes, speed distribution, altitude distribution; number of arrivals, departures, overflights, and withins (within sectors); number of flight plans, separation incidents, traffic management
- Hardware and software performance information
- Data to determine the average times and speeds of flights within sectors and sectors traversed per flight.

RECORDING SUPPORT is presented in Figure 63 on page 191.

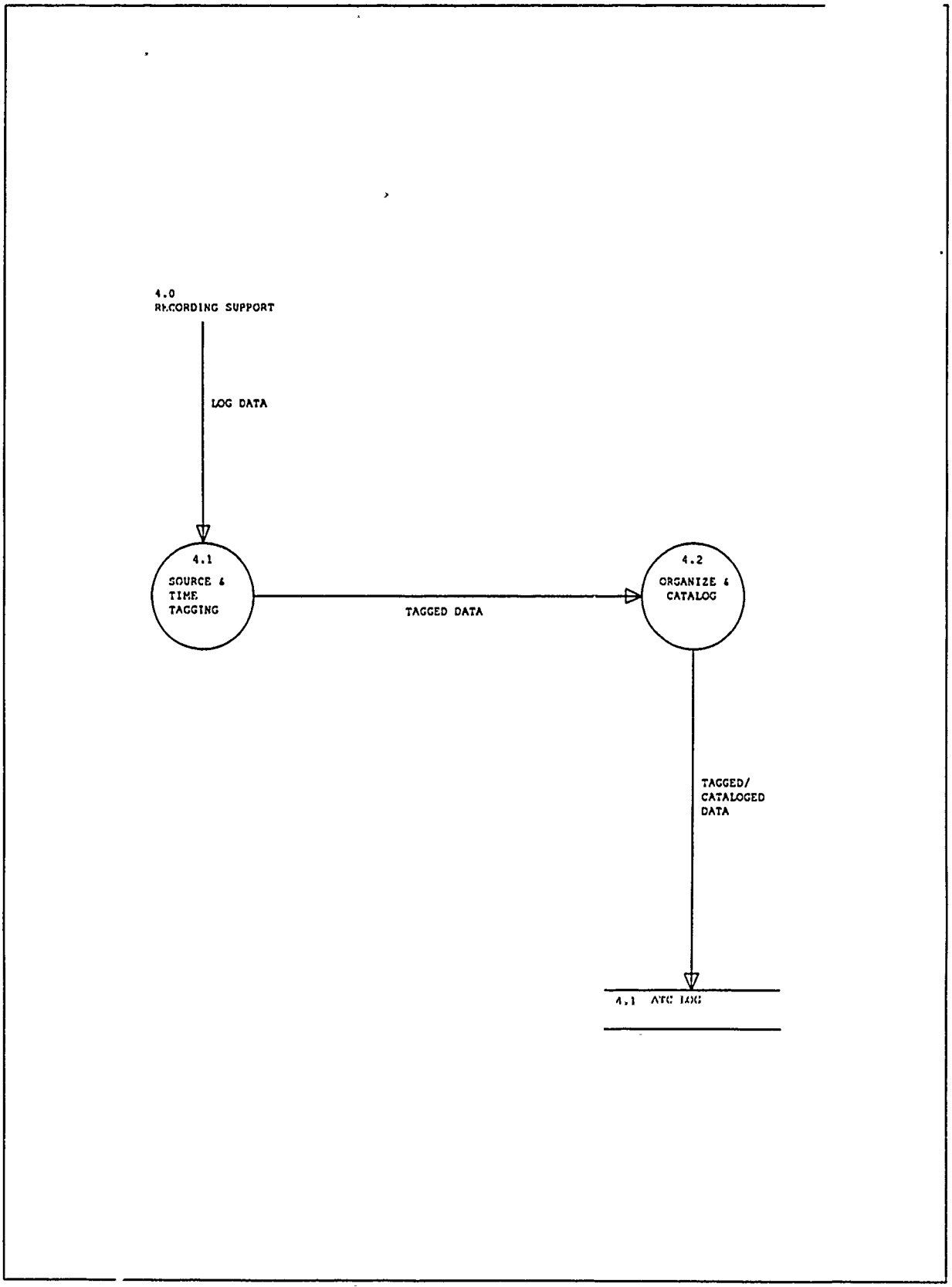


Figure 63. 4.1 Recording Data DFD. This figure is the information flow for 4.1 Recording Data.

4.1 Source and Time Tagging

The purpose of SOURCE AND TIME TAGGING is to Identify the source and time of the log data, and output a tag for the data.

4.2 Organize and Catalog

The purpose of ORGANIZE AND CATALOG log data is to sort and categorize the tagged log data and write the data to the air traffic control log.

Section Summary

This section provides summary reports on data employed and derived by the functional object 4.0 Recording Support.

"All Data Flows" Report

The following report, generated from the Excelerator database, identifies all data flows for the Recording Support object.

Name	Alternate Name	Short Descrip.	Last Modify Date
0.14	RULES & REGULATIONS	Follows the rules and regulations dictated by 0.1 AC and ENV Data as to what data should be logged.	891213
M0002	STATUS/EVENTS REPORTS	Log data requested from Airway Facilities for the creation of status/events reports. Reports created by Airway Facil.	891216
M0003	TAGGED DATA	Data sent from 4.1 SOURCE & TIME TAGGING to 4.2 CATALOG & ORGANIZE which has the source and time appended to it.	891216
M0004	TAGGED/CATALOGED DATA	Data that has been source/time tagged and organized and cataloged, and is sent to the ATC log for storage.	891216

"All Data Stores" Report

The following report, generated from the Excelerator database, identifies all data stores for the Recording Support Object. 4.0 Recording Support also employs the following globally defined data store, defined in Appendix A of this document:

- AIRCRAFT_AND_ENVIRONMENT_DATA.

Name	Alternate Name	Long Description	Last Modify Date
4.1	ATC LOG	This data store collects the analyzed log data, and records it at a centralized location for efficient retrieval. Airway Facilities can then retrieve the data that is needed for creating their reports.	891216

Appendix A. Appendix A - All DoD AAS Area Control Data Stores

Name	Alternate Name	Contains Data St	Last Modify Date
0.22	ACTIVE FLIGHT PLANS		891216
0.1	AC AND ENVIRONMENT DATA	RULES AND REGULATIONS AIRCRAFT CHARACTERISTICS ESTABLISHED ROUTES NAVIGATION AID FIXES AIRSPACE BOUNDARIES GROUND OBSTACLES GEOGRAPHIC DATA	891215
0.15	AIRCRAFT CHARACTERISTICS		891215
0.4	AIRPORT AND AP ASSET STATUS		891215
0.11	AIRSPACE BOUNDARIES		891215
6.1.0	BULK FLIGHT PLAN DATA		891215
0.16	ESTABLISHED ROUTES		891215
0.2	FLIGHT PLANS	0.21 INACTIVE FPs 0.22 ACTIVE FPs 0.23 TRIAL FPs 0.24 UP-ROUTE ACTIVE FPs	891215
0.13	GEOGRAPHIC DATA		891215
0.12	GROUND OBSTACLES		891215
0.21	INACTIVE FLIGHT PLANS		891216
0.3	METERABLE FIX COUNTS		891216
0.17	NAVIGATION AID FIXES		891215
0.14	RULES AND REGULATIONS	ASSET TEST REQUIREMENTS	891215
0.5	TRACK HISTORY		891215
0.23	TRIAL FLIGHT PLANS		891215
0.24	UP-ROUTE ACTIVE FLIGHT PLANS		891216

Alternate Name	Long Description
ACTIVE FLIGHT PLANS	The ACTIVE FLT PLNS database contains all flight plans which are currently active in the system. Flight plans are put into this database by 7.0 FLIGHT PLAN OPERATION SUPPORT when a controller activates a flight plan. They are removed from the database by 7.0 when a controller or pilot closes a flight plan.
AC AND ENVIRONMENT DATA	The Aircraft and Environment Database provides information required by Area Controllers, as well as several DoD AAS ACF functional objects. This database provides vital information to assist in aircraft identification (AIRCRAFT CHARACTERISTICS), information to assist in the processing of flight plans (ESTABLISHED ROUTES, NAV AID FIXES), information to assist in surveillance target presentation (AIRSPACE BOUNDARIES, GROUND OBSTACLES, GEOGRAPHIC DATA), and information to assist controllers and other functional objects about DoD AAS rules and regulations e.g what to log, separation rules, etc. This data is all adaptable, and updated by DoD AAS Airway Facilities.
AIRCRAFT CHARACTERISTICS	The AIRCRAFT CHARACTERISTICS database provides controllers and DoD AAS ACF objects with aircraft attributes. This information is used in flight plan processing, aircraft identification and target tracking.
AIRPORT AND AP ASSET STATUS	The AIRPORT AND AIRPORT ASSET STATUS database provides Area and National Flow Control status of airport facilities and their assets. This database would inform controllers of any airport closings, runway closings, status of facility assets, e.g. inoperative surveillance radars, etc.
AIRSPACE BOUNDARIES	The AIRSPACE BOUNDARIES database provides DoD AAS ACF objects with airspace boundary assignment information. This database is adaptable, as airspace coverage requirements change. This database is employed by the display systems of Area Control, and by surveillance systems as a mechanism for filtering target and weather messages outside of an area's assigned boundaries.
BULK FLIGHT PLAN DATA	This database is used to store bulk flight plans until X min. prior to departure. They are stored here by 6.1.3 BULK FLIGHT PLAN PROC. after the flight plan has been syntax and geographically checked. At X min. prior to departure, 6.1.3 removes the plan from the database and sends it to 7.0 FLIGHT PLAN OPERATION SUPPORT for processing.
ESTABLISHED ROUTES	The ESTABLISHED ROUTES database provides agreed-to routes major commercial airline carriers will follow.
FLIGHT PLANS	The FLIGHT PLANS database contains flight plans which have been entered into the system through 6.0A FLIGHT PLAN ENTRY SUPPORT but have not yet been activated. Cannec STERED flight plans are also stored here.
GEOGRAPHIC DATA	The GEOGRAPHIC DATA database provides surveillance systems and Area Control display systems with geographic information and landmarks, such as towers, etc. This data is employed in surveillance target filtering as well as in integrated surveillance view processing of data for presentation to the air traffic controllers.

	Alternate Name	Long Description
1E	GROUND OBSTACLES	The GROUND OBSTACLES database provides information about aircraft hazards within the TRACON boundaries of an airport. This information is provided for display processing by the integrated surveillance information presentation system.
21	INACTIVE FLIGHT PLANS	Flight Plans which have been syntax checked, geographically checked, route checked, and which have trajectory data calculated. These plans are for flights which have not yet departed. The flight plans are put into the database by 6.0 FLIGHT PLAN ENTRY SUPPORT when the flight plan is filed. They are removed from the database by 7.0 FLIGHT PLAN OPERATION SUPPORT when the flight plan is activated.
3	METERABLE FIX COUNTS	
17	NAVIGATION AID FIXES	The NAVIGATION AID FIXES database provides the locations for all aircraft navigation devices.
14	RULES AND REGULATIONS	The RULES AND REGULATIONS database provides air traffic controllers and DoD AAS ACF objects information on air traffic control rules and regulations. Such information includes minimum separation, logging requirements, etc.
5	TRACK HISTORY	The TRACK HISTORY database is maintenaned by TRAFFIC SURVEILLANCE and employed by AIRCRAFT TRACK MANAGEMENT and PREDICTION and RESOLUTION. Histories of target tracks are maintained to identify deviations from filed flight plans, and are used to estimate potential aircraft conflicts.
23	TRIAL FLIGHT PLANS	This database contains trial flight plans. They are entered here when 6.0 FLIGHT PLAN ENTRY SUPPORT receives a request to process a trial flight plan. They are removed from this database whenever an amendment flight plan which matches the trial flight plan is received, or after the trial flight plan has been in the database more than X min.
24	UP-ROUTE ACTIVE FLIGHT PLANS	This database contains the flight plans which are active in an up-route area. They are stored here when an up-route area sends the flight plan to this area for an extended probe. They are not updated (ie, not syntax checked, etc., nor are trajectories for them saved). They are put in this database by 6.0 FLIGHT PLAN ENTRY SUPPORT when it receives the extended probe request. They are removed from this database when 6.0 receives the handoff indicating the flight is now in this area.

Appendix B. Appendix B - Excelerator Data Dictionary Disk Directory

The DoD AAS ACF IOM Excelerator database files will be placed on the STARS repository. This database is named:

- DODACFDB.EXE - The DoD AAS ACF Excelerator Database. The size of this file is 160,739 bytes.

The Excelerator database files have been archived using the PKWARE[1] PKZIP utility, and prepared for automatic self-extraction using the MAKESFX, PKSFX and ZIP2EXE utilities. None of these utility programs are required to unpack the file.

To prepare this file for use with Excelerator, you must do the following:

1. Upload "DODACFDB.EXE" to an IBM PC compatible PC running DOS 3.0 or higher;
2. Copy this file to your hard disk or high density floppy disk;
3. Set your DOS command line to the letter of the disk device on which you will be unpacking the file. For example, if you have uploaded the file and have copied it to a 1.2 Megabyte 5 1/4" floppy disk and plan to use your "A" drive, type "A:" at the DOS command line and press the enter key;
4. At the DOS command line, type *DODACFDB* and press the enter key;
5. Wait until the unpacking procedure has been completed, which will be signified by the printing of the DOS prompt on your display. After the unpacking procedure has been completed, you will have a total of 72 files on your disk;
6. Invoke Excelerator and create a project named *DODACF*
7. Import the database into the DODACF product through the "XLD INTERFACE" utility
8. When promped for the Excelerator file name, enter *A:\DODACF*

[1] PKWARE, Incorporated is a developer of Shareware application software. PKZIP(tm) and PKSFX(tm) are registered trademarks of PKWARE, Incorporated. None of PKWARE's utility software is transferred in a form usable by another user upon completion of the self-extracting file set archive. The unarchiving program is included and cannot be separated from the *DODACFDB.EXE* executable file.

Appendix C. Appendix C - IOM Methodology Notes Presentation Foils

This appendix includes the IOM Methodology Notes Presentation foils presented at the QM15 Phase II final review, describing modeling rules we learned during phase II.

IQM15 Phase II Activity
DOD Advanced Automation System IOM
IOM Methodology Notes
Presentation Version 1.1

17 December 1989

W. H. Ett

IBM Corporation
Systems Integration Division
800 North Frederick Avenue
Gaithersburg, Maryland 20879

Contents

IOM METHODOLOGY NOTES

IQM15 TASK OBJECTIVE

- LEARN THE TECHNIQUES USED BY FOXBORO USED IN THE SPECIFICATION OF SYSTEMS
- APPLY FOXBORO'S TECHNIQUES TO BUILD A SYSTEMS SPECIFICATION FOR A SELECTED SYSTEM
- BUILD AN IOM THAT EXEMPLIFIES:
  - OBJECT-ORIENTED ORGANIZATION
  - REUSABLE ANALYSIS PRODUCTS
  - POSITIONING FOR SYSTEM DESIGN IN Ada

WHAT IS AN IOM?

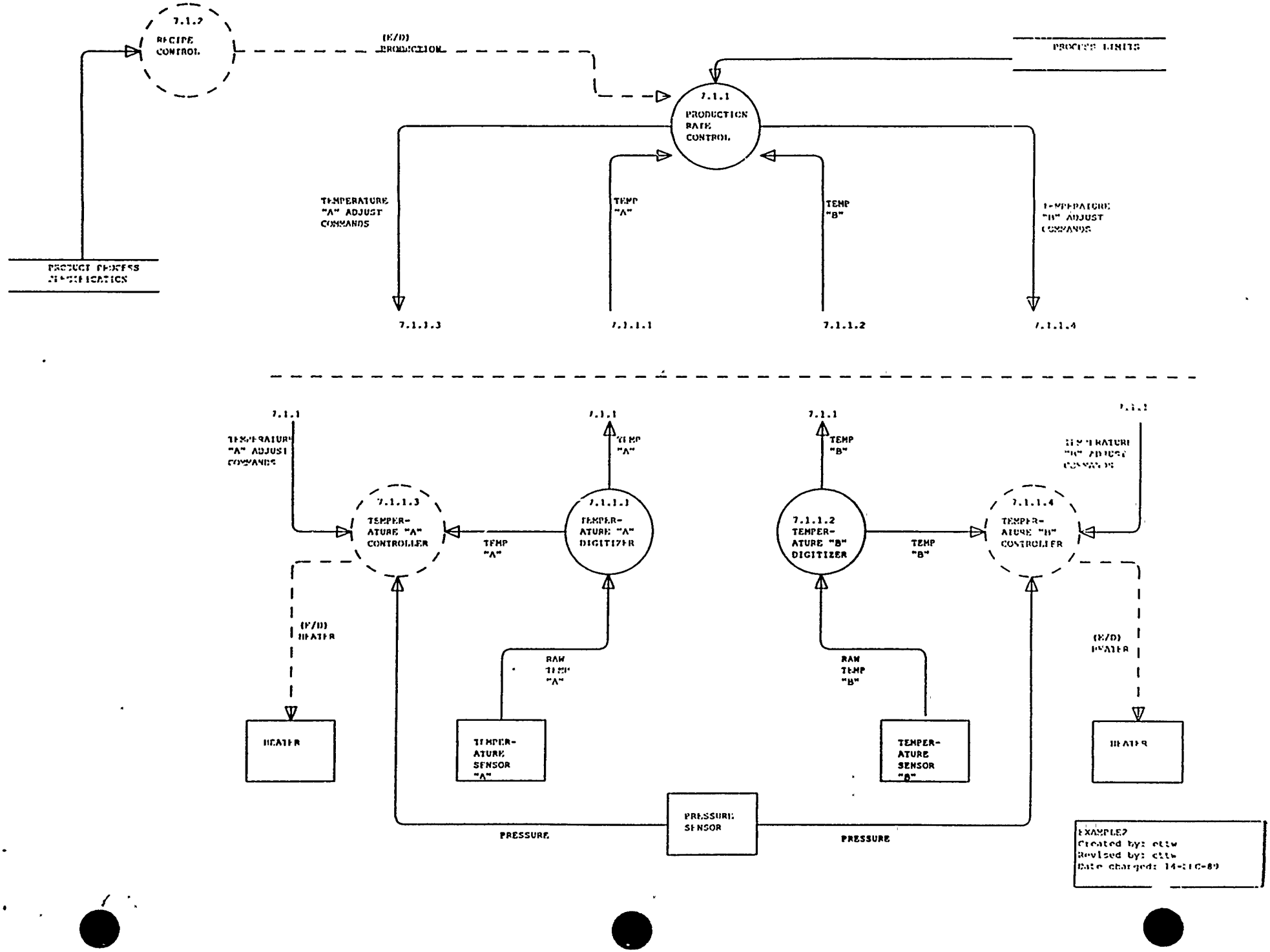
- A SPECIFICATION FOR A SYSTEM THAT WAS "CRAFTED" USING FOXBORO'S TECHNIQUES OF MODELING
  - METHOD OF RAPIDLY ACCUMULATING AND ASSIMILATING KNOWLEDGE
  - METHOD OF MODELING DATA AND CONTROL MESSAGE COMMUNICATION PATHS BETWEEN FUNCTIONAL OBJECTS
    - PEER TO PEER COMMUNICATION
    - PARENT TO CHILD COMMUNICATION
    - CHILD TO PARENT COMMUNICATION
  - METHOD OF ORGANIZING FUNCTIONAL OBJECTS, BASED ON THEIR FUNCTIONAL CAPABILITIES
  - METHOD OF PRESENTATION - LAYERED INFORMATION PACKAGING APPROACH

WHAT IS A FUNCTIONAL OBJECT?

- A FUNCTIONAL OBJECT IS AN OBJECT THAT PERFORMS ONE OR MORE FUNCTIONS
  - IT HAS STATE
  - IT HAS INTERNAL DATA
  - IT EXHIBITS BEHAVIOR
  - IT HAS OPERATIONS THAT BOTH RECEIVE AND PASS MESSAGES

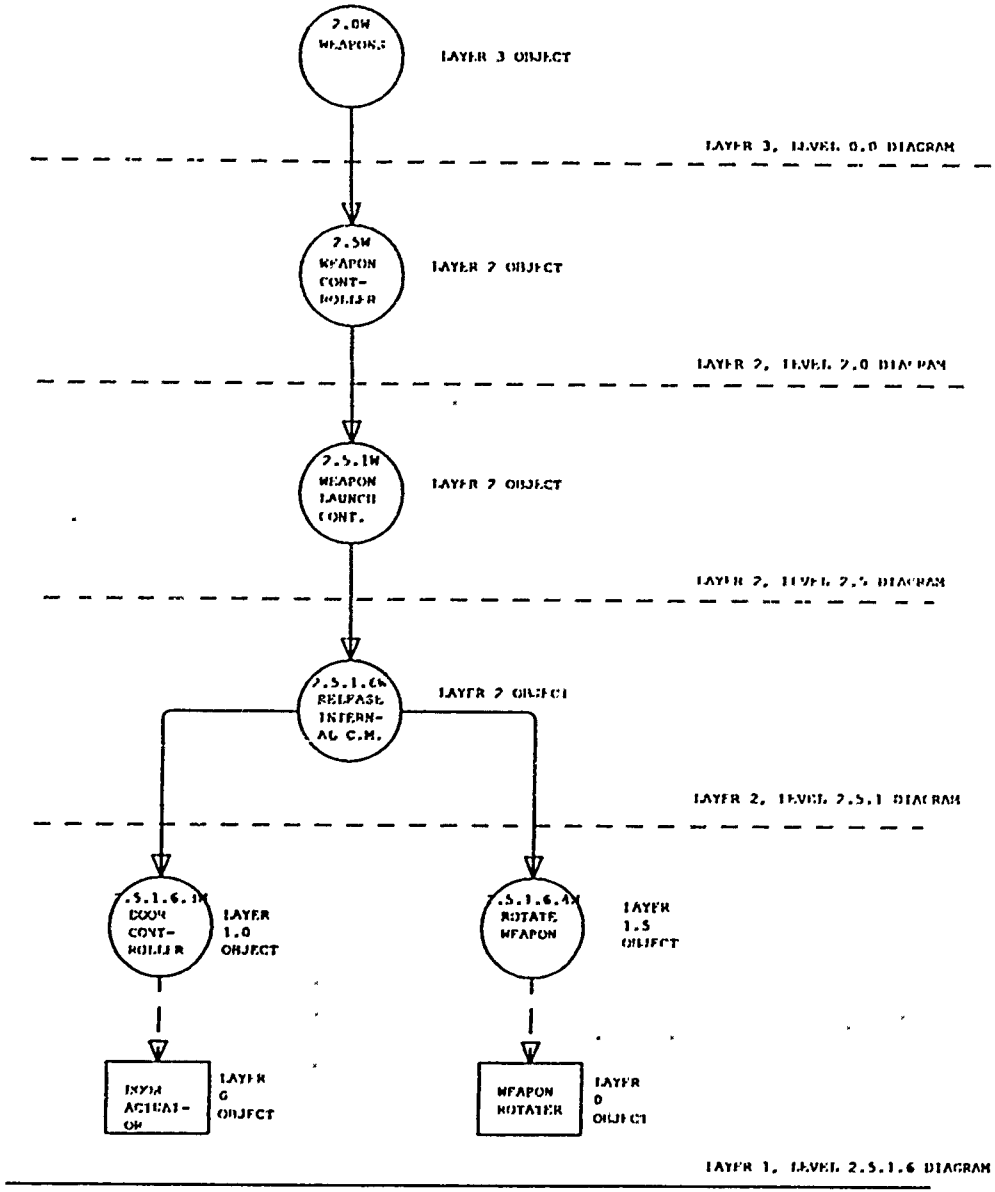
EXAMPLE OF PROPER IOM FORM

- PRODUCTION RATE CONTROL EXAMPLE


7.1.2
RECIPE CONTROL
(E/D) PRODUCTION
PROCESS LIMITS
7.1.1
PRODUCTION RATE CONTROL
PRODUCT PROCESS SPECIFICATION
TEMPERATURE "A" ADJUST COMMANDS
TEMP "A"
TEMP "B"
TEMPERATURE "B" ADJUST COMMANDS
7.1.1.3
7.1.1.1
7.1.1.2
7.1.1.4
7.1.1
TEMPERATURE "A" ADJUST COMMANDS
7.1.1.3
TEMPER-ATURE "A" CONTROLLER
7.1.1
TEMP "A"
7.1.1.1
TEMPER-ATURE "A" DIGITIZER
TEMP "A"
(E/D) HEATER
HEATER
RAW TEMP "A"
TEMPER-ATURE SENSOR "A"
7.1.1
TEMP "B"
7.1.1.2
TEMPER-ATURE "B" DIGITIZER
TEMP "B"
RAW TEMP "B"
TEMPER-ATURE SENSOR "B"
7.1.1
TEMPERATURE "B" ADJUST COMMANDS
7.1.1.4
TEMPER-ATURE "B" CONTROLLER
(E/D) HEATER
HEATER
PRESSURE SENSOR
PRESSURE
PRESSURE
EXAMPLE7
Created by: ettw
Revised by: ettw
Date changed: 14-DEC-89

IOM LAYERS AND MODELING LEVELS

- CAPABILITY IS ASSIGNED TO EACH FUNCTIONAL OBJECT, BASED ON THE LAYERED MODEL
- MULTIPLE LEVELS CAN EXIST FOR AN IOM LAYER OF CAPABILITY
- FUNCTIONAL OBJECTS AT EACH LEVEL:
  - PASS DATA AND CONTROL MESSAGES TO PEER OBJECTS
  - PASS DATA AND CONTROL MESSAGES TO PARENT OBJECTS
  - PASS DATA AND CONTROL MESSAGES TO CHILDREN OBJECTS
- DIAGRAMS ARE PREPARED FOR EACH LEVEL



LAYER VERSUS LEVEL:

- THIS DIAGRAM ILLUSTRATES THE ION LEVELING OF THE "WEAPONS" FUNCTIONAL OBJECT.
- BASED ON THE LAYERED MODEL, ION LEVELS BELONG TO A LAYER OF FUNCTIONAL OBJECT CAPABILITY.
- OBJECTS IN EACH OF THE LEVELS PASS DATA AND CONTROL MESSAGES TO PEER, PARENT AND CHILDREN OBJECTS AS REQUIRED.
- A DIAGRAM IS PREPARED FOR EACH LEVEL.

LAYER VS LEVEL
Created by: ettw
Revised by: ettw
Date changed: 14-DEC-89

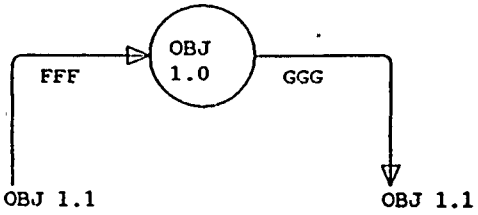
Chart 10

WHITE LAYERED MODEL

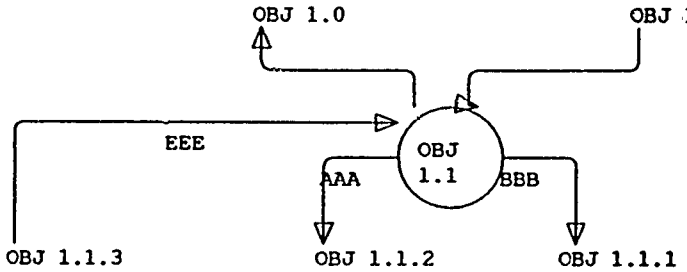
- STRATEGIC PLANNING - CORPORATE (LAYER 5.0)
- MANAGEMENT CONTROL - MIS (LAYER 4.0)
- REAL TIME DECISION SUPPORT - REAL TIME MANAGEMENT (LAYER 3.0)
- SUPERVISORY CONTROL (LAYER 2.0)
- ADAPTIVE CONTROL (LAYER 1.5)
- LOGIC CONTROL (LAYER 1.0)
- SENSOR / DEVICES (LAYER 0.0)

IOM MODELING GUIDANCE

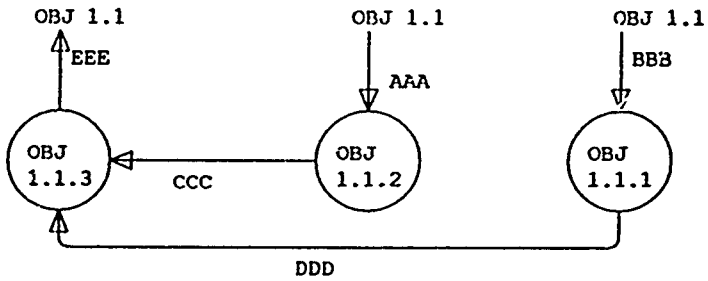
- FUNCTIONAL OBJECTS SHOULD COMMUNICATE WITH EACH OTHER
- THEY SHOULD TYPICALLY POSSESS TWO OF THE THREE CASES:
  - PEER TO PEER DATA AND CONTROL MESSAGE PASSING
  - PARENT TO CHILD DATA AND CONTROL MESSAGE PASSING
  - CHILD TO PARENT DATA AND CONTROL MESSAGE PASSING



LAYER 3, LEVEL 0.0 DIAGRAM



LAYER 3, LEVEL 1.0 DIAGRAM



LAYER 3, LEVEL 1.1 DIAGRAM

OBJECT SHOULD HAVE AT LEAST TWO OF THE THREE:

A) PEER TO PEER COMMUNICATION (DATA/CONTROL)

B) PARENT TO CHILD COMMUNICATION (DATA/CONTROL)

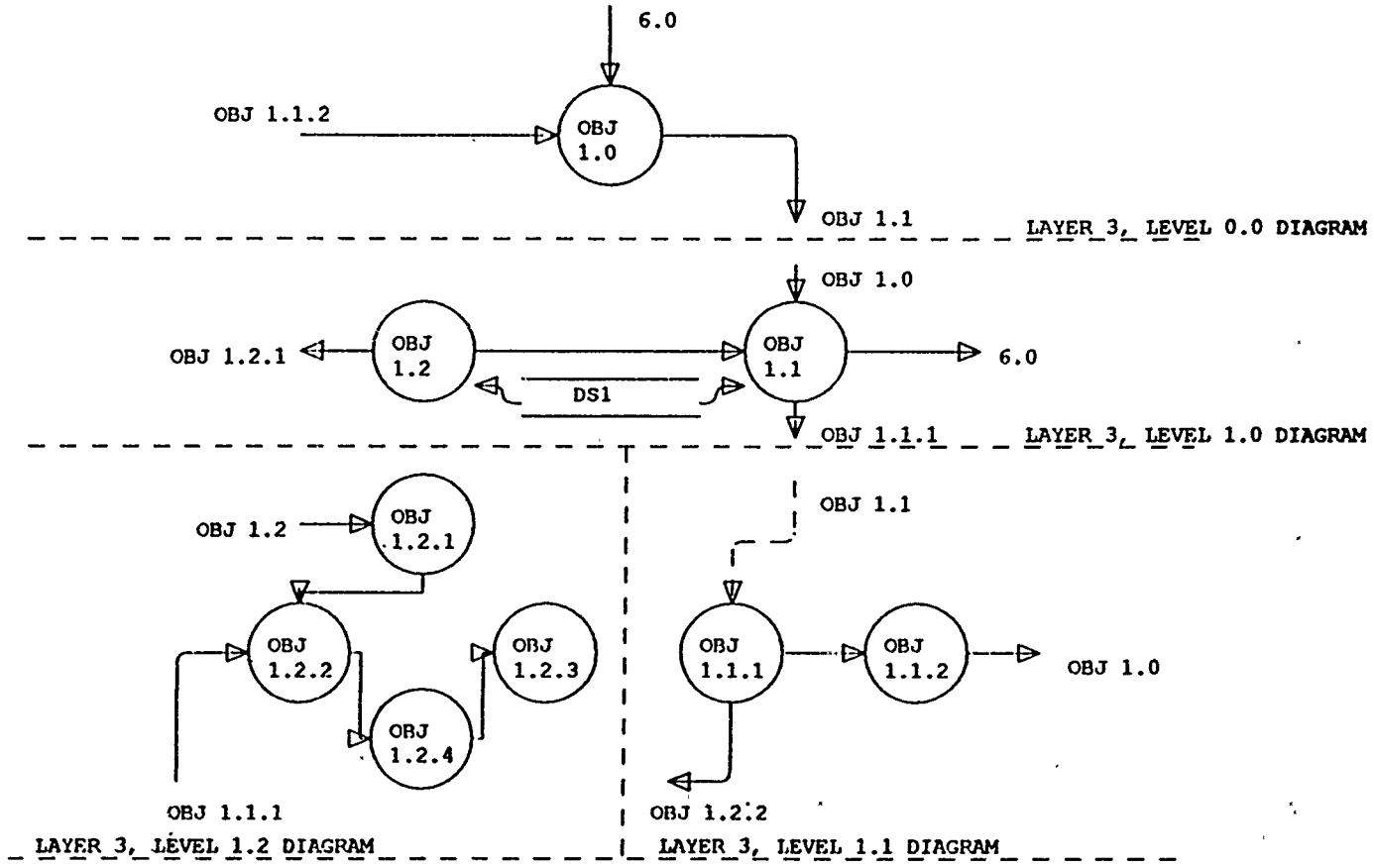
C) CHILD TO PARENT COMMUNICATION (DATA/CONTROL)

PARENT CHILD PEER
Created by: ettw
Revised by: ettw
Date changed: 14-DEC-89

CHART 30

IOM MODELING GUIDANCE - POSSIBLE OBJECT COMMUNICATION PROBLEMS

- OBJECTS SHOULD COMMUNICATE WITH LEVELS DIRECTLY ABOVE OR BELOW OR WITH PEER OBJECTS
- IF AN OBJECT BYPASSES A LEVEL, COMMUNICATING DIRECTLY WITH A GRANDPARENT OBJECT, A MODELING PROBLEM MAY EXIST
- IF AN OBJECT COMMUNICATES WITH A COUSIN OBJECT, A MODELING PROBLEM MAY EXIST
- POSSIBLE PROBLEMS:
  - HOLLOW BUBBLES
  - IMPROPER LEVELING



POSSIBLE OBJECT COMMUNICATION PROBLEMS:

1) TYPICALLY OBJECTS COMMUNICATE WITH THEIR PEERS OF PARENT OR CHILD LEVELS. THEIR MAY BE A PROBLEM WITH OBJECT 1.1.2 WHO DIRECTLY SENDS DATA TO OBJECT 1.0, BYPASSING THE PARENT LEVEL.

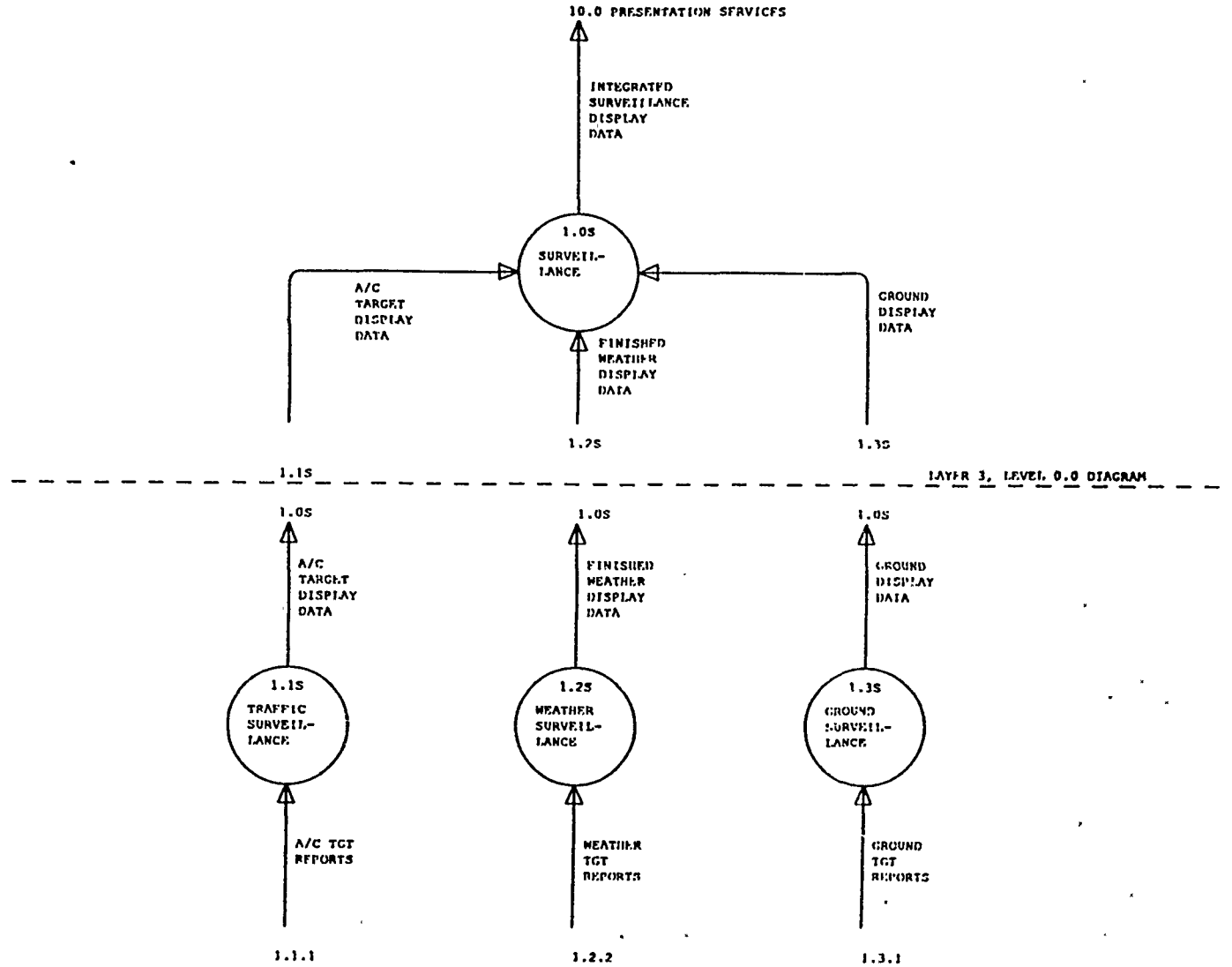
2) OBJECT 1.1.1 COMMUNICATES WITH OBJECT 1.2.2; IN AN IOM, COUSIN OBJECTS SHOULD NOT COMMUNICATE.

OBJECT COMMUNICATION PROBLEMS
Created by: ettw
Revised by: ettw
Date changed: 14-DEC-89

CHART60

IOM MODELING GUIDANCE - NON-COMMUNICATING PEERS

- OBJECTS IN A GIVEN LEVEL SHOULD HAVE SOME FORM OF COMMUNICATION
- THIS IS NOT A HARD AND FAST RULE, BUT SHOULD BE EXAMINED
- POSSIBLE PROBLEMS
  - IMPROPER ALLOCATION OF FUNCTIONAL OBJECTS - OBJECTS MAY NEED TO BE PROMOTED



POSSIBLE IOM PROBLEM: ALTHOUGH THIS DRAWING IS A PERFECTLY REASONABLE IOM REPRESENTATION:

1.1, 1.2 AND 1.3 DO NOT COMMUNICATE WITH EACH OTHER

- NO PEER TO PEER MESSAGE PASSING

- NO PEER TO PEER CONTROL

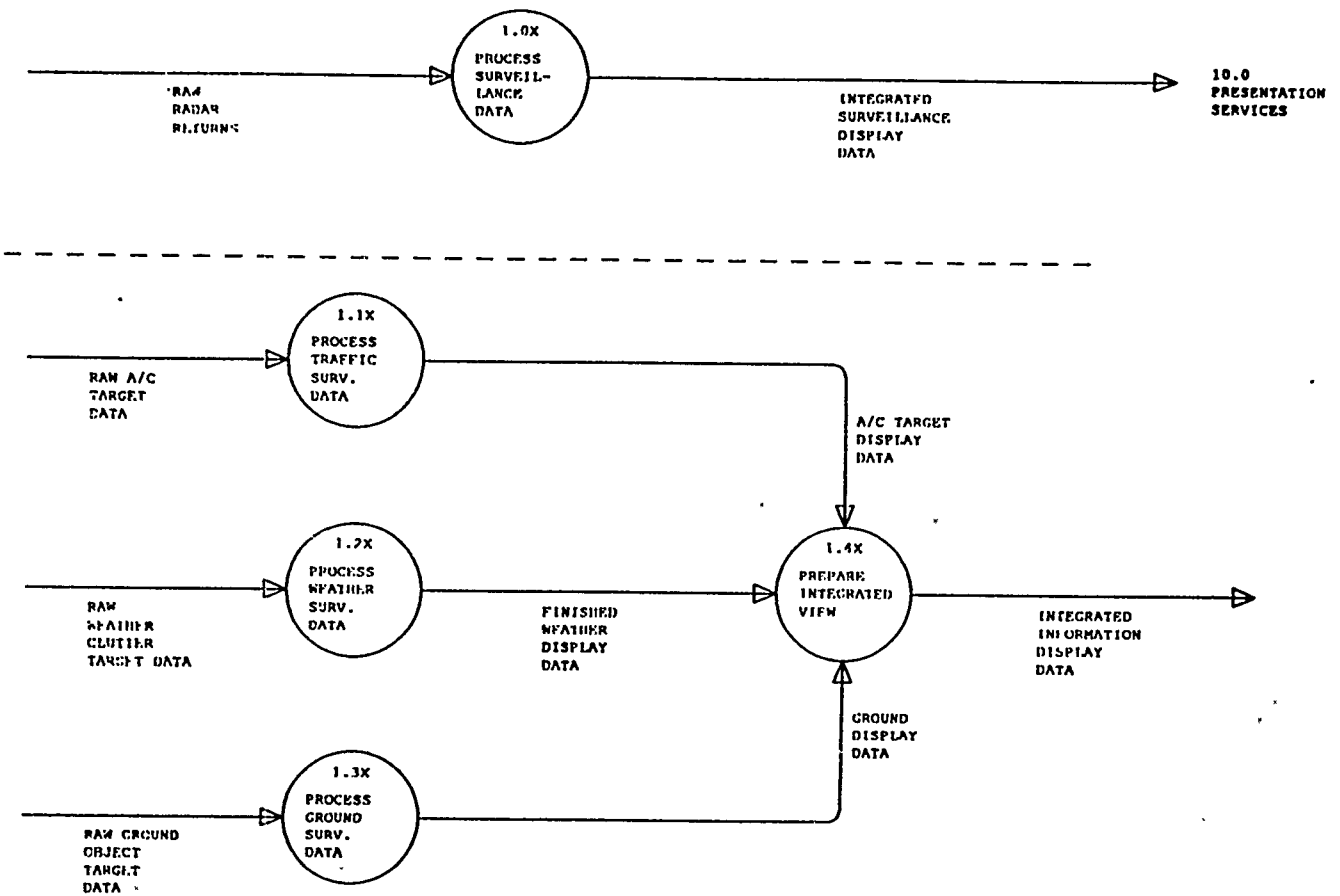
1.1, 1.2 AND 1.3 MAY NEED TO BE PROMOTED OR COALESCED

NON-COMMUNICATING PEERS
Created by: ettw
Revised by: ettw
Date changed: 14-DEC-89

CHART 20

IOM MODELING GUIDANCE - "HOLLOW BUBBLES"

- GENERALLY, IN AN IOM, "HOLLOW BUBBLES" ARE BAD
  - "HOLLOW BUBBLE" IS A TERM USED FOR PACKING SEEMINGLY RELATED PROCESSES FOR CONVENIENCE OF REPRESENTATION
  - USED HEAVILY IN STRUCTURED ANALYSIS
- PROBLEMS:
  - BREAKS THE IOM RULE THAT ALL OBJECTS MUST PERFORM WORK
  - SERVES ONLY, AT MOST AS A DATA AND CONTROL MESSAGE PASS-THRU
  - CAN OBSCURE THE FACT THAT AN ORGANIZATION IS IMPROPER



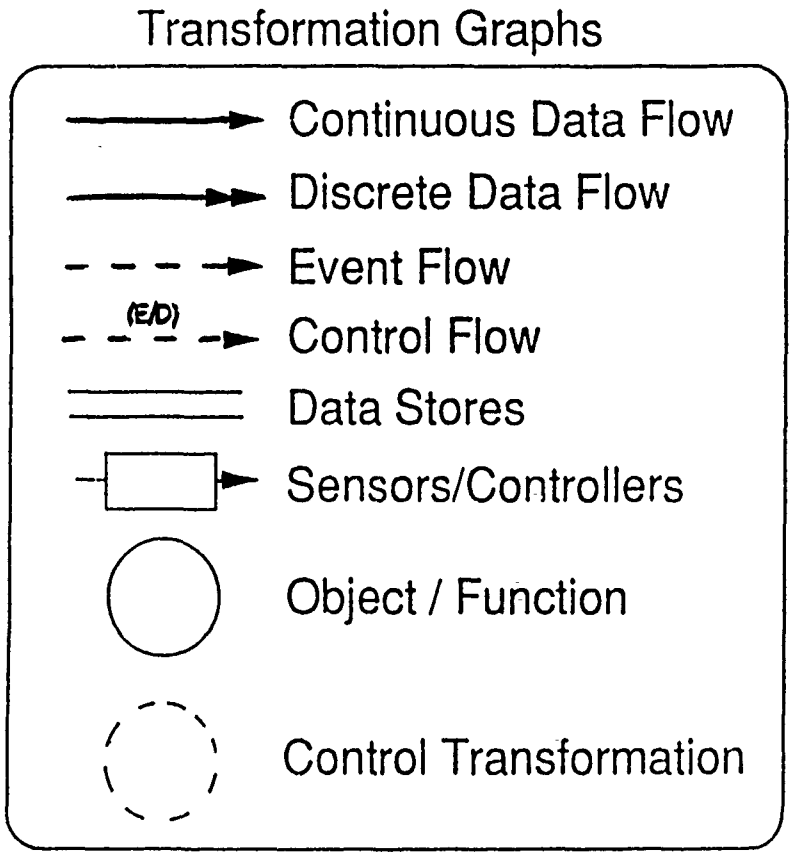
STRUCTURED ANALYSIS VIEW OF SURVEILLANCE:

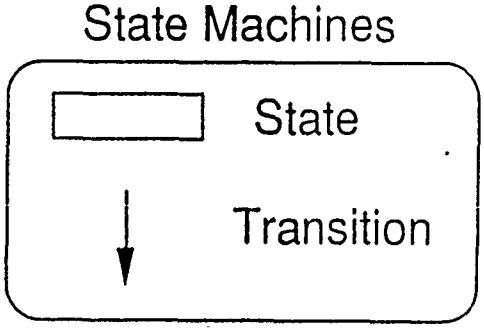
1.0 IS A "HOLLOW BUBBLE":

- 1.0 REPRESENTS A PACKAGING OF PROCESSES FOR CONVENIENCE; MAY OBSCURE THE FACT THAT REORGANIZATION MAY BE DESIRABLE
- FOR THE SAKE OF "DATA FLOW ACCOUNTING", RAW A/C TARGET DATA IS DISPLAYED, EVEN THOUGH IT IS CONSUMED AT LOWER LEVELS
- DOES NOT HIGHLIGHT MESSAGE COMMUNICATION AS AN IOM REPRESENTATION WOULD

HOLLOW BUBBLE
Created by: cttw
Revised by: cttw
Date changed: 14-DEC-89

Appendix D. Appendix D - IOM Diagram Notation





ATTACHMENT A

LIST OF REPORTS SUBMITTED TO DTIC

STARS Technical Plan Analysis (Final)
Environment Capability Matrix
Repository Guidelines and Standards
Foundation Tools Guidance and Education
STARS Structure (DoD AAS IOM Document Version 1.3)
Information Object Modeling Methodology
Software-First Life Cycle Final Definition
Practical Aspects of Repository Operations
Repository Operations and Procedures
Updated Application Blueprint Definition for C3
Repository Guidebook (Final) Technical Report
Repository Prototype System Specification
SGML Product Review
Technical Report: DTD Creation
Briefing DTD User's Guide
SGML Lessons Learned
Sample Tailoring of 2167A DIDS for Software-First Life Cycle
General Definition of Project (Ada/SQL Binding)
User's Manual for a Prototype Binding of ANSI-Standard SQL
to Ada Supporting the SAME Methodology

NOTE: The report "Repository Guidebook (Final) Technical Report" includes three smaller reports:

IBM STARS Repository Guidebook
STARS Repository User's Guide
STARS Reusability Guidelines

Information Object Models (IOM)

This section provides the Information Object Models for the major functional objects. The functional objects presented are:

- 1.0 Traffic Surveillance
- 2.0 Weather Surveillance
- 3.0 Prediction and Resolution
- 5.0 Aircraft and Track Management
- 6.0 Flight Plan Entry Support
- 7.0 Flight Plan Operation Support
- 8.0 Area Control
- 4.0 Recording Support.

Functional objects 8.0 Area Control and 4.0 Recording Support are included, but are not complete. Personnel assigned to complete these objects were released by management, before they could complete their required documentation assignments.

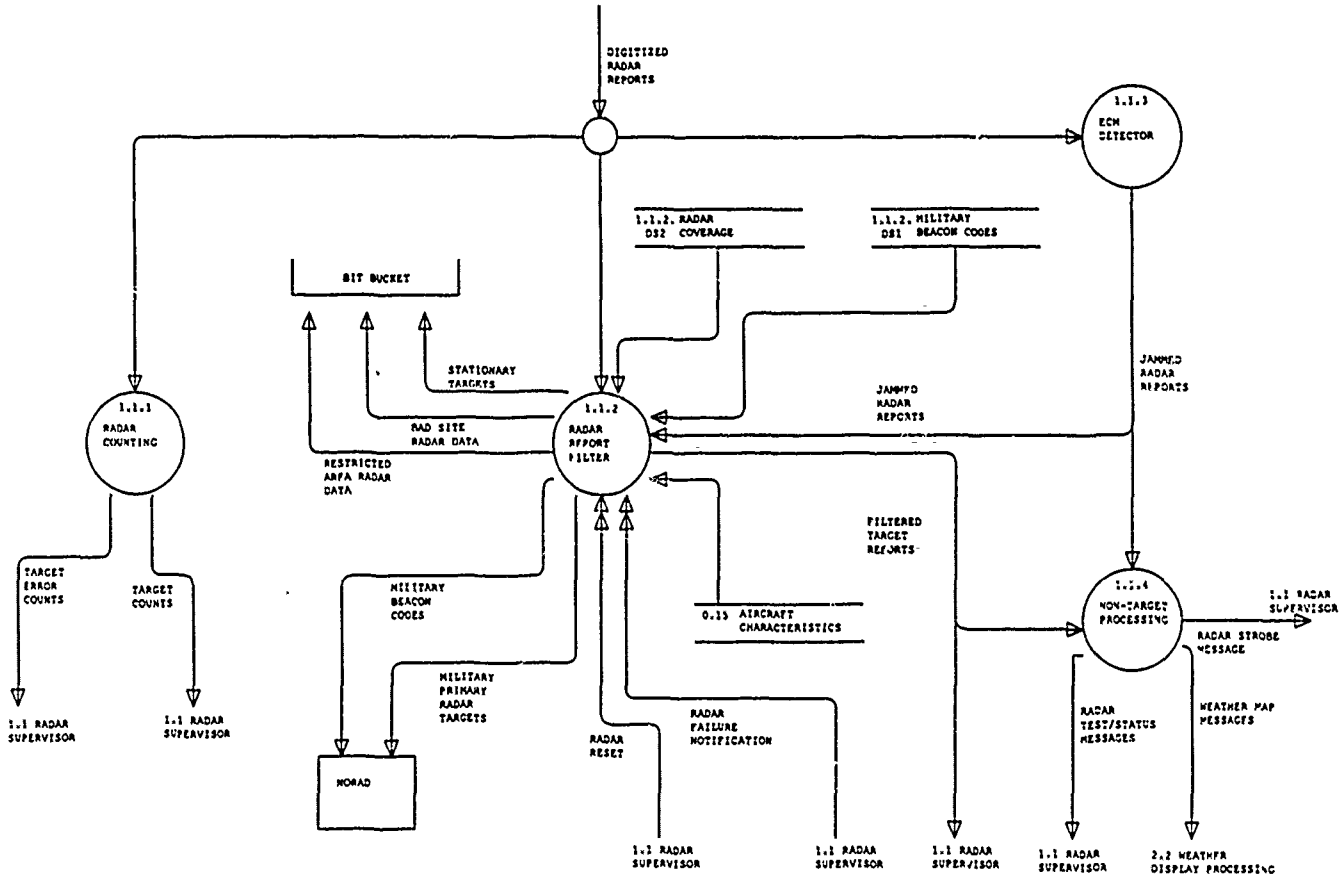


Figure 14. 1.1 RADAR SUPERVISOR. This figure illustrates RADAR SUPERVISOR and its children objects, 1.1.1 RADAR COUNTING, 1.1.2 RADAR REPORT FILTER, 1.1.3 ECM DETECTOR, 1.1.4 NON-TARGET DATA PROCESSING.

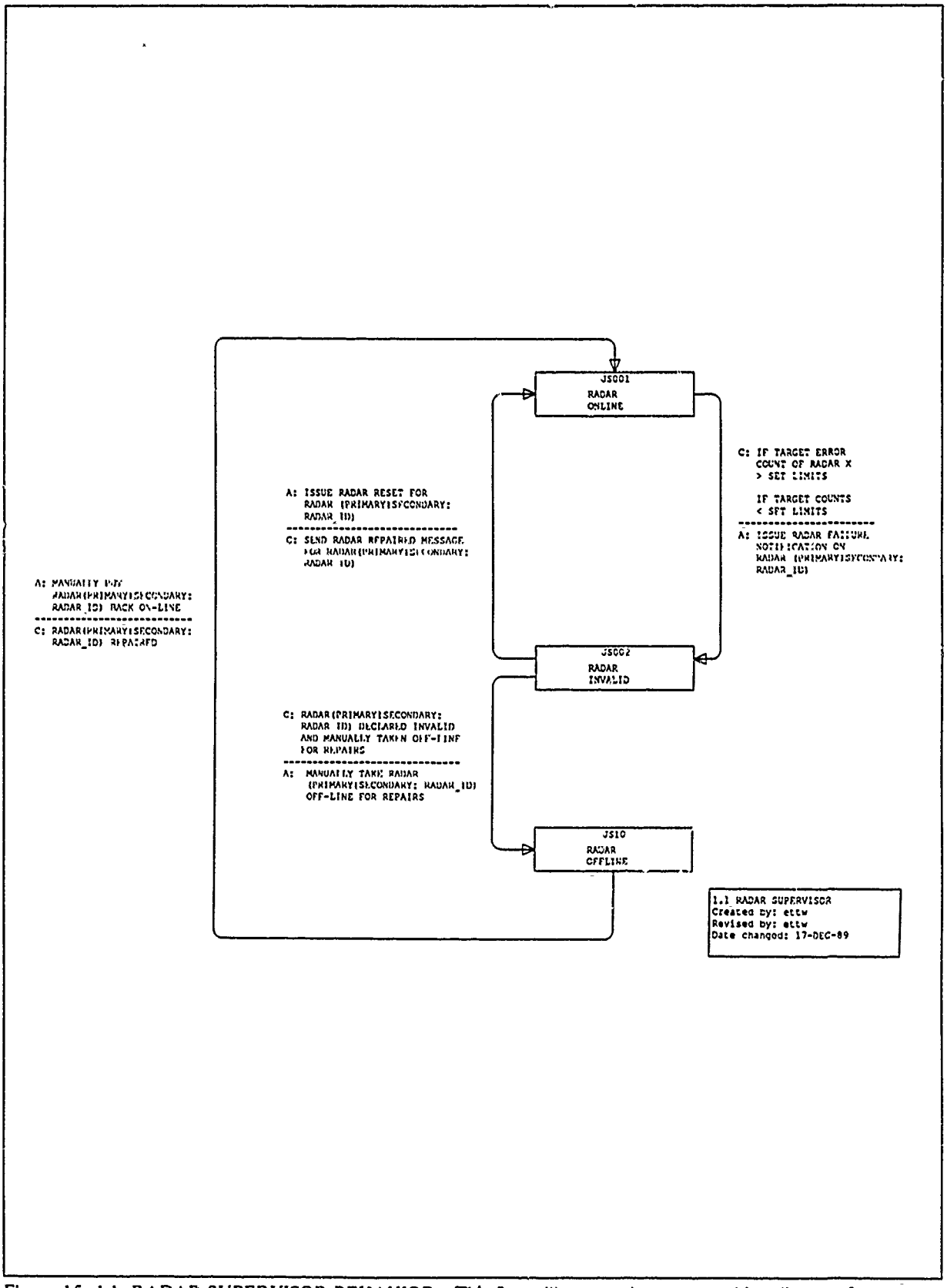


Figure 15. 1.1 RADAR SUPERVISOR BEHAVIOR. This figure illustrates the state transition diagram for changing between three states, namely; RADAR ONLINE, RADAR INVALID, and RADAR OFFLINE.

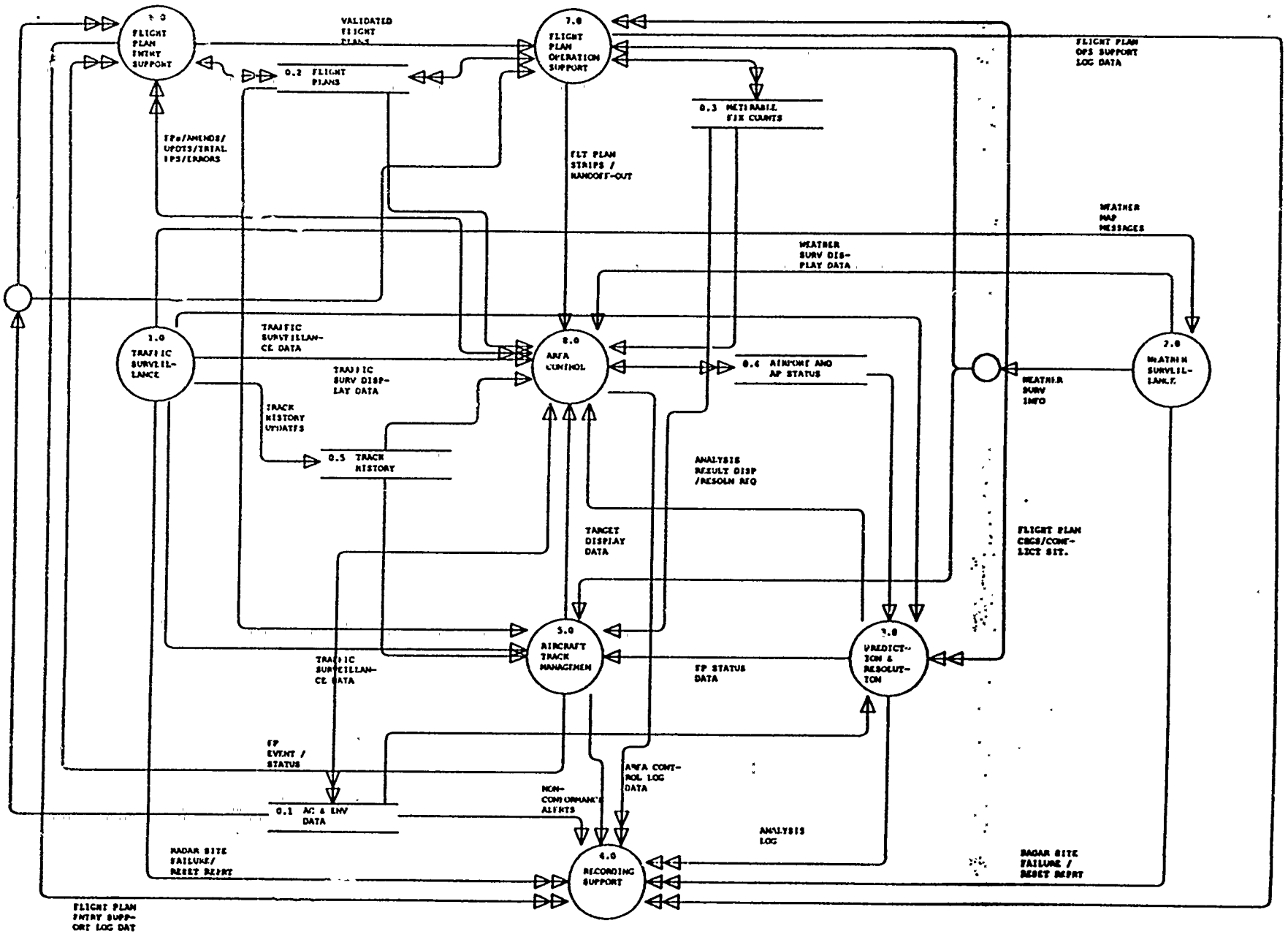


Figure 8. DoD AAS Area Control Facility. This figure illustrates the major functional objects of the DoD AAS Area Control System. The figure also illustrates the information flows between these objects.